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A CONTRIBUTION TO THE STUDY OF HEPATIC ABSCESS.[1]

By William C. Dabney, M.D.,
of Virginia.

This paper was suggested by several cases occurring in my own practice, or seen in consultation, in which some of the most characteristic of the usual symptoms or signs of hepatic abscess were wanting when such an abscess was present, or else in which the symptoms were singularly suggestive of the affection and yet no abscess existed.

It is based in great part upon the analysis of one hundred and eight cases collected from various sources, but I have in some places, when it seemed advisable, utilized other material as well as this.

The paper is not intended as an exhaustive review of the subject, but I trust the facts which I hope to bring out will help to clear up some of the obscure points in connection with this disease.

The first question which presents itself, of course, in any systematic study of suppuration in the liver is the nature of the germs or substances which cause this suppuration, but I do not feel qualified to express an opinion on this point. It seems to me, however—if I may venture to express *any* opinion—that the investigations of Hankin, Prudden, Hodenpyl, Welch, and others tend to show that there are quite a number of germs and substances which are capable of causing pus formation under favorable conditions.

That some bacteria or their products, however, are directly connected with the formation of hepatic abscess is almost if not quite certain, and we have next to inquire *from what points these bacteria or their products come and through what channels they reach the liver.* There are several

[1] Read before the Association of American Physicians at Washington, May, 1892.

conceivable channels through which pyogenic germs or substances may reach this organ.

By the bloodvessels. Entrance of germs by the hepatic artery was formerly considered a common cause of hepatic abscess, and it was claimed that injuries of the head or of the bones generally were especially apt to cause this affection. Frerichs, for instance, stated that "the supervention of hepatic abscess from inflammation of the veins of the systemic circulation was of far more common occurrence than abscess arising from phlebitis of the portal veins;" but this view does not accord with the facts, so far as definite information can be obtained. Waldeyer found hepatic abscess in only six per cent. of those who died from surgical diseases, while embolic processes in the lungs were present in more than two-thirds; and Klebs found that "thirty-two cases with metastasis in the lungs occurred to eight in the liver."[1]

Barensprung (quoted by Thierfelder) states that in thirty-three cases of traumatic diseases resulting from injuries of the head, hepatic abscesses were found in six; and Prescott Hewitt, in eighteen injuries of the head, found hepatic abscesses in three and abscesses of the lungs in thirteen.[2]

It would scarcely be proper to make any use of the records of our civil war in this connection, because the constant strain and pressure to which the surgeons both North and South were subjected during those troublous times left them but little time for careful pathological research; but it is not probable that if hepatic abscesses had been of frequent occurrence they would have been overlooked so completely by all the surgeons on both sides; and yet in 12,980 cases of injuries of the head which are reported in the first surgical volume of the *Medical and Surgical History of the War of the Rebellion* I can find no record whatever of an abscess of the liver and but one case which suggests this affection —death being attributed in this to "hepatitis." In addition to this one case of hepatitis, nine of pyæmia are reported, but the seat of the abscesses in these cases is not mentioned.

Of the one hundred and eight cases which I have tabulated for the purposes of the present study there is but one in which it seems in the slightest degree probable that the embolus leading to the hepatic abscess passed through the systemic veins and the hepatic artery to reach this organ. In this case, reported by Harris,[3] a man entered the hospital for an ulcer on the leg; about two months after admission an hepatic abscess formed; was aspirated, and later incised and drained, and the patient recovered.

The occurrence of hepatic abscess in connection with or as a result of malignant endocarditis ought, it would seem, to be of comparatively

[1] Ziemssen's Cyclopædia, vol. ix. p. 99.

[2] Holmes's System of Surgery, vol. i.

[3] Lancet, Oct. 1, 1887.

common occurrence—much more common at least than in those cases where the primary disease is so situated that the embolus has to pass through the lungs before it can reach the arterial system; but, as a matter of fact, very few cases have been reported, so far as I can learn. Thierfelder refers to two—one reported by Mayer and one by Buckling—but the size of the abscesses in these cases is not mentioned. It is probable that this form of cardiac disease runs such a rapid course, and the general symptoms are so pronounced, that the hepatic disease is overlooked before death, and it is also probable that the hepatic abscesses would be of small size and little practical importance. We are justified in concluding, it seems to me, that the occurrence of hepatic abscess from injuries or diseases of the bones or other parts of the body, except those immediately adjacent to the liver, or else directly connected with the portal system of veins, is rare, and the slight danger which formerly existed in such cases has been in great measure removed by the antiseptic or aseptic method of treating wounds.

The conveyance of pyogenic germs or substances by the *hepatic veins* and the consequent formation of abscess in the liver must be extremely rare, if such a thing ever occurs. I can find no cases which seem to have originated in this way, though Younge states[1] that the large single tropical hepatic abscesses are connected with the hepatic veins; the small, mutiple ones with the portal veins. There is abundant evidence, however, that the large so-called tropical abscesses are often, if not generally, connected with the portal vessels. Mr. Godlee says:[2] "It appears to be certain, also, that thrombosis and subsequent suppuration may occur in the hepatic veins or their tributaries," but he gives no cases in proof of the statement.

Pyogenic infection through the portal system of vessels is usually considered the most common source of origin of hepatic abscesses, and in a very large proportion of cases which have been carefully studied there seems to have been ulcerative disease of some of the organs connected with the portal system or there was a history of such ulceration at some previous time. Thus, in one hundred and fifty-six cases of acute or chronic catarrhal inflammation of the intestinal mucous membrane *without* ulceration, occurring during our civil war, there was but one case of hepatic abscess, while there were fourteen cases of multiple abscesses and nine of large single abscesses occurring in five hundred and eleven cases of flux in which the intestine was ulcerated."[3] In a considerable proportion of cases, however, there is no history of previous disease of the intestines or any of the organs connected with the portal system.

Of the one hundred and eight cases which I have studied, there were

[1] Med. Press and Circular, Aug. 14, 1889. [2] British Medical Journal, 1890.
[3] Medical and Surgical History of the War of the Rebellion, vol. ii. p. 548.

only forty-seven in which there had been a history of disease of any of these organs or in which post-mortem examination showed that such disease had existed; and in one, at least, of these cases the dysentery had existed so long before (eight years) that its connection with the hepatic abscess is *extremely* doubtful. Of the forty cases reported by physicians in this country, eleven were apparently due to disease of the organs connected with the portal system, and in sixteen the cause was unknown; in several of these cases it was distinctly stated that there was no history of diarrhœa, dysentery, or any other disease. The individual diseases and injuries of the organs connected with the portal system to which hepatic abscess has been attributed are (1) dysentery, (2) appendicitis, (3) gastric and duodenal ulcer, (4) operations on or diseases of the rectum, (5) typhoid fever, (6) suppuration of the umbilical veins in infants, (7) ulceration of cervix uteri, (8) peri-uterine inflammation, (9) suppurating ovarian cysts, (10) lithotomy operations.

Before going further it will be well to call attention to the fact that the word "pyæmic" in connection with hepatic abscess is used differently by different writers on the subject.

It is used by some to denote all those abscesses which result from the lodgment of an embolus in the bloodvessels of the liver, and by others it is restricted to those cases which occur in connection with well-marked symptoms of general septicæmia. While it is hard, perhaps, to draw a fast and sharp line between these two classes of cases, it seems to me better, from a clinical point of view, to use the word pyæmic in the restricted sense. The first fact which strikes one in connection with ulceration of the intestinal canal and hepatic abscess is that all forms of ulceration do not lead to abscess. Sir Dyce Duckworth states[1] that it does not result from either tubercular or typhoid ulceration. As to the second of these he is clearly mistaken, as I shall show a little later on, but I have not been able to find any cases which were clearly due to tubercular ulceration of the bowel. In the case reported by Thorowgood,[2] it is probable that the pus-like collections in the liver were really broken down tubercle and not pus. A probable explanation of the circumstance that tubercular ulcers of the bowel do not cause hepatic abscess is to be found in the fact that tubercles are so scantily supplied with bloodvessels.

The ulceration of typhoid fever is a rare source of abscess of the liver. Bernhard reports[3] a case following typhoid fever and terminating fatally in which the cicatrices of the typhoid ulcers were found at the autopsy. Musser refers[4] to a case in which the intestinal ulcers had healed, but the mesenteric glands had suppurated. It is not easy to understand why

[1] Lancet, April 23, 1887.
[2] Ibid., 1889, ii. p. 268.
[3] Jahrb. für Kinderheilk., 1886, p. 303.
[4] Cyclopædia of Dis. of Children.

hepatic abscess should be so rarely connected with typhoid ulceration. Arnaud advanced the view[1] that it was due to the fact that Peyer's patches are connected with the lymphatics, and that the vessels are comparatively little involved in typhoid fever, but this view is scarcely tenable. Luchtmanns[2] found "follicular ulcers" of the intestines in sixty-one of one hundred and two cases of hepatic abscess, and, furthermore, Peyer's patches are very abundantly supplied with bloodvessels.

Ulceration of the bowel, which often causes dysenteric symptoms, and hence is spoken of as dysentery simply, is usually considered the most common cause of hepatic abscess; but it was frequently remarked, even before the investigations of Councilman and Lafleur, that the dysentery was unlike the common form, and was often mild in character.

Younge mentions[3] that dysentery was extremely common during the Crimean war, but only one hepatic abscess was reported, and he refers also to the statistics of Niemeyer and of Finger, who report three hundred and eleven autopsies in cases of dysentery without finding a single hepatic abscess. Cullimore states[4] that he was informed by Dr. Danford Thomas that he never saw a case of hepatic abscess during his term of service as coroner of London. Sir Dyce Duckworth says[5] that ordinary dysentery does not cause hepatic abscess, and Bartholomew[6] makes a similar statement.

In many cases the ulceration of the bowel and the dysenteric symptoms are so mild in character as scarcely to attract attention. Dickinson reports[7] a case in which there was a large hepatic abscess, with no symptoms or history of dysentery, but at the autopsy ulceration of the colon was found. Keiner and Kelsch refer[8] to a case reported by Moxon to the Medical Society of London, in which diarrhœa was present for one day only; death occurred from the opening of an hepatic abscess into a large vein, and at the autopsy a very small ulcer was found in the colon.

De Gennes and Kirmisson report[9] a case in which the discharges from the bowels were abundant and glairy in character, and there was little tenesmus.

In many cases, on the other hand, the ulceration of the bowel is deep and extensive, as in the cases described by Councilman and Lafleur.

It is evident, therefore, that so far as ulceration of the bowel is concerned, the hepatic abscess is not due to the character of the intestinal ulceration; and it is almost certain, if not positively established, that it

[1] Marseille Méd., 1887, p. 146.
[2] Quoted by Thierfélder.
[3] Med. Press and Circular, August 14, 1889.
[4] Ibid., November 30, 1887.
[5] Loc. cit.
[6] Pepper's System of Medicine.
[7] Trans. Path. Soc. of London, 1862.
[8] Archives Gén. de Méd., Sept. 1888.
[9] Ibid., 1886, ii. p. 288.

is due to the character of the substances formed in the intestinal ulcers, and carried thence to the liver.

There are two or three other questions in connection with hepatic abscess consequent on dysentery which are of interest, namely: (1) How soon after an attack of dysentery commences may hepatic abscess develop? and (2) How long a time must elapse after apparent recovery from dysentery until the danger of hepatic abscess is over?

To the first of these questions a definite answer can be obtained. In the cases of amœbic dysentery reported by Councilman and Lafleur there was distinct evidence of pus formation in the liver in three weeks in two cases and in five weeks in one case. Indeed, they themselves put the time[1] at two weeks in one case, but they say the usual time was from the fourth to the twelfth week. In a case reported by De Gennes and Kirmisson the intestinal trouble occurred early in September and lasted fifteen days; the abscess had clearly formed by September 20th, and was aspirated October 17th. Geschwind reports[2] a case in which, three weeks after the first symptoms of dysentery, pus was expectorated; a little later a small quantity was aspirated, and then an incision was made through which three-fourths of a litre were discharged.

A case almost exactly similar is reported by Barthélemy and Bernardy,[3] pus being obtained on aspiration in three weeks from the commencement of the dysenteric attack, and the case being then treated by free incision, with recovery.

It is extremely difficult—practically impossible, in fact—to say how long a time must elapse after *apparent* recovery from dysentery before the patient is free from the danger of hepatic abscess. There are two obvious difficulties in the way. In the first place, ulceration of the bowel may continue long after the dysenteric symptoms have disappeared, and, secondly, an hepatic abscess may remain latent for an indefinite time. Cullimore states[4] that of twelve cases occurring in his practice in India, dysentery "immediately preceded" the abscess in only two. Lamb has reported[5] a case in which a man had dysentery in August, and an hepatic abscess showed itself the following December; but in this case, though the dysenteric symptoms had disappeared four months before, the cæcum was found ulcerated at the autopsy. Muselier reports[6] a case of multiple abscesses of the liver, in which the man had dysentery in Guadaloupe some months before. In another case the patient had dysentery six months before the abscess appeared, and Olliphant reports[7] a case in which "diarrhœa" occurred a year before. A

[1] Johns Hopkins Hospital Reports, vol. ii. p. 466.
[2] Arch. de Méd. et Pharm. Militaire, 1889, xiv. p. 203. [3] Ibid., 1890, xv. p. 288.
[4] Loc. cit. [5] New Orleans Med. and Surg. Journ., February, 1887.
[6] Gaz. Méd. de Paris, November, 1885.
[7] New Orleans Med. and Surg. Journ., May, 1887.

case presenting several peculiar features is reported by Guyot:[1] A man, thirty-eight years old, had suffered with chronic dysentery, but he had apparently recovered three years before the hepatic abscess appeared. In September he was taken sick with indigestion, weakness, pain in the right flank, and gradual emaciation; *he had no fever;* by January there was decided swelling on the right side, and great pain and tenderness; aspiration showed the presence of pus, and a month after one aspiration, at which 1500 grammes of pus were withdrawn, the patient was well. Quite a number of cases have been reported in which dysentery preceded abscess formation by several years; thus, O'Donnell,[2] after stating his belief that ulceration of the bowel is a rare cause of hepatic abscess outside the tropics, mentions a case in which dysentery preceded the abscess by nine years; and Faunce and Rowan report[3] a case of abscess occurring eight years after dysentery. At first sight one would suppose that there could be no possible connection between the dysentery and the hepatic abscess in these cases, nor is it probable that there *was* any connection, but it is certain that ulceration may exist in the bowels for a long time after apparent recovery from dysentery, and an hepatic abscess may remain latent for a long time certainly, but just how long is not known. Another interesting fact just here is that dysentery may recur in the same person one or several times after an interval of several months or even several years. A case of this kind has recently come under my observation. A gentleman was taken, in the autumn of 1881, after a visit to a marshy section of Virginia, with a severe attack of dysentery; he recovered in a few weeks' time, but in 1884 and in 1888 he had similar attacks. In January last he was again attacked, and I saw him in consultation in February. An examination of the discharges, made by my colleague, Prof. Tuttle, showed that they contained amœbæ. The case ran a tedious course, but finally ended in recovery.

The entrance of pyogenic substances into the liver by the *lymphatics* is of questionable occurrence; but it seems to me highly probable that the frequent extension of such abscesses into the adjacent pleura and lung may occur through the lymphatic vessels of the liver, "which communicate with the thoracic lymphatics through the triangular ligament and suspensorium."

Suppuration may occur around the *bile-ducts* and lead to abscess formation from several different causes: (1) Retention of bile;[4] (2) the

[1] Bull. et Mém. de Soc. Méd. des Hôpitaux, 1886, p. 368.

[2] Med. Press and Circular, June 19, 1889.

[3] Indian Med. Journ., 1888, p. 539.

[4] Godlee says the simple distention of the bile-ducts does not cause abscess; that it only occurs when some foreign body, such as a gall-stone or a worm, causes ulceration of the duct.

presence of gall-stones; (3) the entrance into the ducts of intestinal worms; (4) probably, also, from an angiocholitis of unknown origin.

Cases of this character do not seem to be very common when compared with the total number of hepatic abscesses reported, but if so-called tropical abscesses be left out, they are probably comparatively common. Musser has collected seven cases in which the abscesses were caused by round worms, and other cases have been reported. One of the most remarkable was reported[1] by Bates a number of years ago. A negro child, three years old, was taken with violent pain in the belly, paroxysmal in character and very severe; there was great tenderness over the region of the liver, and the organ was somewhat enlarged; the child lived nine days. At the autopsy two abscesses were found in the liver, one of which contained one and one-half ounces of pus; in addition to these abscesses, however, forty-two round worms were found in the substance of the liver, and similar worms were found in the intestines.

Of thirteen cases of multiple small abscesses collected by Carrington,[2] three were due to obstruction to the outflow of bile. Leyden also reports[3] a case of multiple small abscesses due to gall-stones, and a similar case is reported by Harris.[4] In Harris's case there were many small abscesses in the pancreas, as well as in the liver. So far as I can learn from the reported cases, abscesses which originate from trouble about the bile-ducts are usually small in size and multiple, but this is not always the case. Polaillon[5] reports a case of very large single abscess beginning as an angiocholitis, and Kermisson[6] one due to gall-stones in which there were one large and several small abscesses. The abscesses were in the right lobe. The biliary canals were "enormously dilated," the pus was thick and yellow, the wall of the abscess dark, and small bloodvessels opened into the abscess; there was also a small abscess in the right lung.

Spread of suppurative inflammation from adjacent parts or organs may occasionally induce hepatic abscess. Beckham has recorded[7] a case in which an abscess originally between the abdominal wall and liver, or possibly in the abdominal wall, extended to the liver, and caused erosion or ulceration of its outer surface; there was a fistulous opening into the sac, through which pus and fragments of hepatic tissue were discharged. Councilman and Lafleur think it probable that there was a direct passage of amœbæ from the colon to the liver in some of their cases of amœbic dysentery.

[1] New Orleans Med. and Surg. Journ., March, 1846.
[2] Guy's Hosp. Reports, vol. xxvi.
[3] Charité Annalen, 1886.
[4] Indian Med. Journ., 1885, p. 603.
[5] Gazette Méd. de Paris, June 18, 1887.
[6] Bull. Soc. Anatomique, 1873, p. 674.
[7] New Orleans Med. and Surg. Journ., 1867, p. 67.

In the cases where it was supposed to result from pneumonia, it is more probable that the abscess was the primary condition, and the pneumonia resulted from it.

Injuries of the liver lead to hepatic abscess in a considerable number of cases, and these injuries may be penetrating wounds, simple contusions without external injury, or they may cause fracture of the ribs, and lead to hepatic abscess, and possibly cause hepatic abscess secondarily.

I can find but three cases of hepatic abscess from penetrating wounds of the liver reported in the *Medical and Surgical History of the War of the Rebellion*. One of these was from a punctured sabre wound, and the other two from shot injuries. In each case the abscess resulted very soon after the receipt of the injury.

As a rule, the abscesses due to other forms of injury, such as blows, appear in a few days. Eight of the one hundred and eight cases in the table were clearly due to injuries, and in these cases the interval from the receipt of the injury to the appearance of the abscess varied from four to thirteen days. Thus Barthélemy and Bernardy report[1] a case in which the abscess appeared four days after a blow; Tournier,[2] one four days after a blow on the belly and exposure to cold; Barth,[3] one in which the liver was enlarged in three days, though pus was not aspirated for three months; Siredey,[4] one in which a man received a kick from a horse, and pus was present in eight days, and Weir,[5] one in which, after a fall on the buttocks, an hepatic abscess formed in thirteen days. In two cases the interval between the injury and the abscess formation is not stated, and in three, while the abscesses were supposed to have been due to injury, the evidence is by no means conclusive.

I shall have but little to say about the *general or local conditions which are favorable to the development of hepatic abscess.*

A *hot climate* is universally considered a potent factor, but it is quite evident that it is not the *heat* simply which is the active agent, because the disease is not equally common in all hot countries.

Perhaps the chief action of heat is in furnishing one of the conditions requisite for the growth and development of amœbæ; it is probable that those abscesses which are so greatly influenced by climatic conditions are amœbic in character.

Harley,[6] Cullimore,[7] and Younge[8] think chilling of the body when

[1] Archives de Méd. et Pharm. Militaire, 1890, xv. p. 285.
[2] Provence Méd., November 22, 1890.
[3] Bull. Soc. Anatomique, 1856, p. 111.
[4] Ibid., 1858, p. 499.
[5] New York Med. Record, April 29, 1882.
[6] Med. Press and Circular, February 3, 1886.
[7] Ibid., November 30 and December 7, 1887.
[8] Ibid., August 14, 1889.

overheated a potent cause, and Cullimore claims that horseback riding is liable to induce it.

There is much difference of opinion with respect to the influence of *malaria*, but the weight of evidence seems to be clearly against any connection between the two diseases. Cullimore, Keiner and Kelsch, Dutrolau—in fact, nearly all writers on tropical affections—deny such a connection. Blanc,[1] on the other hand, considers malaria a powerful, predisposing cause, and Tomes[2] thinks malaria a frequent attendant on hepatic abscess. The rarity of hepatic abscess in those sections of the eastern part of the United States where malaria prevails, furnishes strong presumptive evidence against any connection between the two diseases; but Bartholow states that hepatic abscess is common in the Mississippi Valley, and of twenty cases occurring in the St. Louis Hospital reported by Robinson,[3] in ten "intermittent fever," "chills and fever," or "chills" are mentioned as causative or complicating conditions. In seven of the ten cases, however, dysentery or diarrhœa had preceded the abscess; in two of the other three cases the chills and fever occurred during the time the abscess was forming, or after it had formed, and in the other there had been no chills for four years until about six weeks prior to the appearance of the abscess.

Mr. Godlee,[4] in his lectures on the "Surgical Aspects of Hepatic Abscess," states his belief that malaria is sometimes connected with abscess formation in the liver. It seems to me probable that the only real connection between malaria and hepatic abscess is to be found in the fact that the same conditions are favorable for the development of the plasmodium malariæ and the amœba of amœbic dysentery. Possibly malaria may weaken the resisting power of the liver, and thus act as a predisposing cause also.

Intemperance is universally recognized as a predisposing cause of hepatic abscess in India, and it is probable that it is elsewhere. It is worthy of note, too, that even "moderate drinkers" are very liable to the disease in India. Hatch[5] reports seventeen cases; of these seven used liquor to excess, and nine were moderate drinkers.

With respect to *age and sex*, adult males are far more liable to hepatic abscess than children or women. Chiefly, perhaps, because they are more exposed to the predisposing and exciting causes; but young people are by no means as exempt from this affection as was formerly supposed. Musser[5] has collected thirty-four cases in persons under fifteen years old, and many other cases have been reported. Thus Hill records[6] the

[1] Lancet, February 20, 1886.
[2] Lancet, October 9, 1886.
[3] St. Louis Courier of Medicine, January, 1879.
[4] Lancet, January 5, 1889.
[5] Indian Med. Journal, 1887, p. 204.
[6] Cyclopædia of Diseases of Children, vol. iii.

case of a boy nine years old, who had suffered from repeated attacks of periodical fever, in whom an hepatic abscess developed. It was incised and drained, and discharged nearly half a pint of greenish pus.

McClelland reports[1] the case of a girl eight years old, who swallowed a pin fourteen months before, and "about that time" had pain in the right groin; the case terminated fatally, and at the autopsy, one abscess the size of an orange, and many smaller ones were found in the liver, and one in the brain.

A case is also reported[2] by Pereira in a child twenty months old who had dysentery in November, and the abscess appeared in the following December.

Janeway has also reported[3] a case in a child three years old, and the case reported by Bates in a child of three years, has already been alluded to.

The usual *seat*, the *number*, and the *size* of hepatic abscesses are points of great practical importance with respect to prognosis and treatment.

The usual seat of an abscess is in the right lobe, and even when the abscesses are multiple, the right lobe is chiefly involved. Furthermore, it would seem that the *upper* part of the right lobe is involved rather more frequently than the lower part.

With respect to the number of abscesses, it is hard to get definite information. Of the 108 cases which I have studied there were multiple abscesses in 42 cases; while in 55 there was but 1; in 11 cases the number of abscesses were not stated. In those cases which complicate general septicæmia, it is quite certain that the abscesses are in the great majority of cases multiple in number and small in size, but these cases are of little *practical* interest at any rate, and it is of far more importance to determine, if possible, the size and number of the abscesses in those cases which offer some hope of relief from remedial measures.

Of the 8 cases in which the disease was *clearly* due to injury, there was but *one* abscess in 4 cases; in one there were 2; and in one 6; and in one (Siredey's case) "many;" in the other the number is not mentioned, but it would appear from the context there was but 1.

Of the 4 cases *probably* due to injury, in 2 there was but 1 abscess; in 1 there were several; and in 1 the number is not stated.

Of the 31 cases in which there was a history of either dysentery or diarrhœa, or in which ulceration of the large bowel was found, at the autopsy there were multiple abscesses in 15 cases.

In 14 cases there was but 1, and in 2 the number is not stated. Of

[1] Lancet, April 10, 1886.
[2] Indian Medical Gazette, June, 1890.
[3] Trans. New York Med. Assoc., 1884.

38 cases in which the cause of the abscess could not be discovered, 27 were single, 9 multiple, and in 2 the number was not stated.

Eighteen of these 38 abscesses were reported in the United States, and of the 18, 15 were single, 2 multiple, and in 1 the number was not stated.

Twelve were reported by French physicians, and of the 12, 4 were multiple.

Eight were reported by English physicians, and of these 4 were multiple and 4 single.

One of the American cases reported here as one of multiple abscesses presented peculiar features. It is reported by Schoolfield in the *Cincinnati Lancet and Clinic* for December 28, 1889. In this case there were four abscesses, but they appeared at different times. The first burst into the lung, and a month after apparent recovery another abscess appeared, which was incised and drained in two weeks. Recovery seemed to be complete in a month's time, but two months after the second apparent recovery, a third abscess appeared, which was incised and drained in three weeks time; recovery was slower then, and was only complete after four months. Two months later still the abscess recurred for the third time, broke into the lung and abdominal cavity and caused death.

A somewhat similar case of recurrent abscess has been reported by Rozemont-Malbot. The first abscess in this case broke and recovery ensued; a second appeared twenty months later, was incised and drained, and the patient was well in forty days; five months later a third abscess appeared and was incised, but general peritonitis supervened and terminated fatally.

Of 8 cases of abscess due to obstruction of the bile-ducts, 7 were multiple and 1 single, and it is questionable whether that was actually located in the liver. In only 1 of the cases was there a large abscess.

Carrington has reported a case in which there were two large and many small abscesses, and he considered the combination very rare; but this view is clearly erroneous, as 7 other cases appear in the 108 which I have collected, in which there were one or two large, with many small abscesses in the same liver.

The relation of multiple abscesses to each other is a matter of direct and practical importance. In a general way it may be stated, perhaps, that the longer a case lasts the greater the probability that multiple abscesses will open into each other, but this fact does not, of course, justify delay in surgical treatment, because the longer the duration the greater, as a rule, is the destruction of hepatic tissue, and the greater is the danger of exhaustion or of the bursting of the abscess in some unfavorable direction. That the presence of one or more additional abscesses may cause death, after one has been opened and drained,

there can be no question. Ferron, for instance, reports[1] 47 cases of antiseptic hepatotomy for abscesses, in 8 of which the abscesses were multiple. Of the multiple cases 5 terminated fatally, while there was but 1 death in the 39 cases of hepatotomy in which the abscess was single.

Tournier has also reported[2] an interesting case of hepatic abscess due to injury, the presence of pus being evident four days after the injury was inflicted. One abscess in this case was opened by Vienna paste and incision, but the case terminated fatally, and at the autopsy another abscess was found which had not been opened.

A somewhat similar case is reported by Arnaud,[3] in which the patient died twelve days after incision into one abscess; at the autopsy the abscess was found healed, but there was another present which had caused death.

Sometimes (how often I have not been able to learn) a second abscess will burst into the one which has been opened. Thus, Cliquet reports[4] a case in which an abscess was incised and drained; there was temporary improvement, but fever, sweats, pain, and prostration recurred. Twenty-four days after the incision there was a sudden and profuse flow of pus, with immediate relief.[5] It seems to me highly probable that the bursting of a second abscess into the cavity of one which has been opened must be of comparatively common occurrence, because the recoveries from hepatic abscess, when one sac only has been opened, are relatively much more frequent than single abscesses.

I shall have but little to say about the *contents* of an hepatic abscess, but there are two or three practical points which it may be well to mention. The first of these relates to diagnosis. It seems to be generally held that aspiration is quite a certain means of detecting the presence of pus, but this is clearly a mistake. Councilman and Lafleur mention the fact that in some of their cases of amœbic abscess the contents were so thick that they would not flow through an aspirator needle, and in a case which I saw in consultation a year or two ago the contents of the abscess had undergone caseous degeneration, and aspiration gave a negative result.

It would be interesting to determine how long it takes for pus in the liver to undergo this caseous change, but there are hardly any facts

[1] Gazette hebdom. de Sci. Méd. de Bordeaux, 1887, p. 159.

[2] Provence Méd., November 22, 1890.

[3] Marseille Méd., 1887, p. 146.

[4] Archives de Méd. et Pharm. Militaire, 1886, i. 299.

[5] I have recently seen a similar case in consultation. I incised and drained one abscess on May 15th; the patient improved greatly for a time, but fever and sweats recurred. On June 20th another abscess burst and discharged through the original opening, and on June 24th a third opened in the same way.

which throw light on this point. Nor would it be easy to determine it, at any rate, because of the frequency with which abscesses are latent.

In the single case which I have seen, it was about six weeks from the time the first symptoms of abscess appeared, till aspiration was attempted. The second point of practical interest in connection with the contents of an hepatic abscess is the frequency with which the contents are sterile. "Bacteria were found in 3 of the 6 cases" reported by Councilman and Lafleur. Laveran has reported[1] 2 cases which were sterile, and Netter, in the discussion following the reading of Laveran's paper, stated that of 13 cases of amœbic dysentery, Kartulis had found 8 sterile; of 9 cases of "idiopathic abscess of hot countries" 4 were sterile. He expressed the opinion, too, that the sterility was due to the long time the abscess had lasted—an opinion which is scarcely tenable in view of the rapid course of some of Councilman and Lafleur's cases.

Peyrot[2] has reported a case in which pus from an hepatic abscess of unknown origin escaped into the peritoneal cavity without any subsequent trouble, and he attributes the absence of peritonitis to the sterility of the pus. This sterility of the pus, or its *possible* sterility, might furnish a crumb of comfort when pus did escape into the abdominal cavity; but it would certainly not justify the failure to prevent such contamination as far as possible.

The presence of liver-cells in the contents of an hepatic abscess does not seem to be of very common occurrence. It is mentioned in 8 of the 108 cases. Occasionally their presence is of great value in diagnosis. A few years ago I saw a gentleman from Cincinnati who was supposed to be suffering from phthisis. At my first visit I found he had been taken a few hours before with profuse discharges of yellowish matter from his bowels. On microscopic examination these were found to consist of pus and fragments of hepatic tissue and liver-cells.

The condition of the walls of the abscess and the surrounding hepatic tissue depends in great measure on the duration of the abscess. In the very early stages there is no very sharp line of demarkation, but later on, the walls are distinct and ragged; still later, they may be thick and fibrous, and Haspel (quoted by Frerichs) states that the fibrous wall may be formed in twenty or twenty-five days; but it is evidently very hard, if not impossible, to say how long a time is necessary for this change in the wall to occur, for abscesses having such fibrous walls pursue a tedious course, and are often latent.

The surrounding tissue is often sound, but it may be fatty, as in cases reported by Dymock[3] and Arnaud.[4]

[1] Bull. et Mém. de Soc. Méd. des Hôpitaux, 1890, p. 691.

[2] Bull. et Mém. de Soc. de Chirurg., February and March, 1891.

[3] Indian Med. Gazette, 1866, p. 298.

[4] Marseille Méd., 1887, p. 146 et seq.

The changes in the neighboring parts and organs are of great practical importance, especially the presence or absence of adhesions.

In 30 of the 108 cases which I have tabulated, the presence of adhesions is mentioned.

In 8 it is mentioned that there were *no* adhesions.

In 70 cases no mention is made of adhesions, one way or the other.

In 11 of the 30 cases, the abscess was due to dysentery, and in 7 of the 11 cases there were multiple abscesses.

In 16 cases the cause of the abscess was unknown, and in 5 of these there were multiple abscesses.

Adhesions were mentioned in only 1 case, when the abscess was due to injury, and then the adhesions were between the liver and the diaphragm.

In 20 of the 30 cases the liver was adherent to the abdominal walls.

A comparison of the symptoms present in those cases where adhesions existed, and in those where there were *no* adhesions, does not indicate any means by which their presence or absence may be determined.

Cliquet[1] thought that œdema of the abdominal walls over the seat of the liver was an evidence of adhesions having formed, but this view cannot be substantiated. The presence of this symptom is noted in only 2 of the 30 cases, and Ramonet has reported[2] a case in which this symptom was present, and in which he distinctly states adhesions were not present.

In 1 other case, however, not included in the 30, where adhesions certainly existed, there was extreme œdema of the skin, and adhesions probably existed because there was necrosis of the ribs in this case.

The *symptoms* of hepatic abscess are usually quite well marked, but are sometimes obscure and occasionally there are no symptoms pointing to hepatic disease.

Thus, Woolbut records[3] a case in which a laboring man, in apparently perfect health, was suddenly seized with severe pain in the abdomen, followed by collapse, and terminating in death in a few hours' time; he had received no injury of any kind and had not had dysentery; at the autopsy, the left lobe of the liver was found ruptured, and in the right lobe were found one large and several small abscesses, the presence of which had never been suspected.

McLean[4] speaks of a case in which a man died of phthisis, who had never presented any symptoms of hepatic trouble, but at the autopsy a cavity the size of a walnut, and containing a rusty needle swallowed two years before, was found in the liver; the abscess-cavity opened into the duodenum and drained in that way. He mentions also another

[1] Loc. cit. [2] Archives de Méd. et Pharm. Militaire, 1889, p. 321.
[3] Indian Med. Gazette, December, 1886. [4] Reynolds' System of Medicine.

case, in which a man with "no previous history of disease" walked seven or eight miles in search of work; soon afterward he complained of sudden pain, became collapsed, and died in a very short time. At the autopsy a large abscess with very firm walls was found which had suddenly burst into the pericardium.

Even close adhesions to surrounding parts may form apparently without giving rise to any symptoms; thus Rohé reports[1] a case in which a woman died quite suddenly with pneumonia; there had been no hepatic symptoms during life; but at the autopsy an abscess holding four ounces was found in the liver, which contained several gall-stones, and was adherent to the stomach, pancreas, duodenum, and gall-bladder.

Tournier (*Provence Méd.*, November 22, 1890) reports a case also in which there were no symptoms pointing to the liver, but in which, at the autopsy, an hepatic abscess was found, and the organ was found closely adherent to the abdominal wall.

McLean expresses the opinion that those cases which present no symptoms are very chronic in course, and the abscesses have thick walls, but this is not always the case.

Souques has recorded[2] a case following old perityphlitis, which presented no symptoms pointing to the liver, but which ran a rapid course, and caused death before rupture of the abscess.

The *onset* of the symptoms in most cases of hepatic abscess is gradual, but now and then is very sudden.

Thus, in a case reported by Ferrand,[3] the patient was taken suddenly with violent pain in the abdomen, with vomiting; he was constipated, but an enema brought away black, offensive matter; the symptoms continued; fever supervened, and the liver became moderately enlarged; death occurred in a month's time, and at the autopsy a number of abscesses, from the size of a bean to that of a pullet's egg, were found, containing grumous muco-pus; the walls were blackish and gangrenous, and there were adhesions to adjacent parts.

Of the usual symptoms of pus-formation—*rigors, fever, and sweating*—fever was present in a very large proportion of the cases.

Its presence is distinctly mentioned in 61 of the 108 cases; there was said to be an absence of fever in 5 cases, in which other symptoms of hepatic abscess were present, but the records are not sufficiently full to be satisfactory on this point. I am at this time attending a case in consultation, in which there is no fever during the day, but at night a rise followed by sweating.

The temperature, except in cases which ran a very rapid course, did

[1] Med. and Surg. Reporter, November, 1881.

[2] Bull. Soc. Anatomique, 1889.

[3] Bull. et Mém. de Soc. Méd. des Hôpitaux, 1887, p. 496.

not usually rise above 102.5° or 103° in the afternoon, and in the morning was often normal; the temperature elevation, furthermore, in most cases occurred at irregular times.

In 44 cases no mention is made of fever, but it is probable that it was present in most of the cases at least.

The occurrence of *rigors* is mentioned in 14 cases only, and sweats are said to have occurred in only 9. Doubtless, in many cases, both the rigors and the sweating were overlooked, but in quite a number of cases it is distinctly stated that they were absent.

Jaundice seems to be present, so far as can be judged from the limited number of cases which I have analyzed, more frequently than is commonly supposed. Its presence is mentioned in 11 of the 108 cases. In two of these cases the jaundice was very slight, however; in one of them there were no adhesions present, and in the other it is not stated whether adhesions were present or not. Of the 9 remaining cases, in 4 there were more or less dense adhesions surrounding the liver or connecting it with adjacent organs; and in the other 5 the jaundice was due to the presence of gall-stones, or other obstruction of the duct, which had given rise to the hepatic abscess. It seems to me highly probable, therefore, that in most cases of hepatic abscess in which jaundice is present this latter symptom is due not to the abscess itself, but to pressure on the bile-ducts by adhesions, or to obstruction by gall-stones.

An *earthy tint* of the skin is mentioned by many of those who have reported cases of abscess of the liver as of common occurrence.

Ascites is reported as present in 6 cases; in one of these the probable cause was suppurative portal phlebitis; in 4, more or less dense adhesions were present, and in 1 the presence or absence of adhesions is not mentioned.

The *digestive* symptoms are variable. There is usually complete loss of appetite, but occasionally it remains good.

Nausea and *vomiting* were noted in 13 of the 108 cases, and in only 6 cases were their absence specifically mentioned.

Diarrhœa was present in 18 cases, and constipation in 10. In 2 cases there were alternate diarrhœa and constipation. In 1 case it is distinctly stated that the bowels were regular. It is evident, therefore, that the condition of the bowels is of but little value as a symptom of hepatic abscess.

Disturbance of the *nervous system*, except pain and tenderness in the region of the liver, which will be considered hereafter, is rarely mentioned. The occurrence of headache is mentioned in 3 cases, delirium in 2, and stupor in 1. No doubt in many cases there were nervous and other symptoms, which are not mentioned by the reporters of the cases; but if these symptoms had been conspicuous, it is scarcely probable that they would have been omitted.

Disturbances of the *circulatory system*, except ascites and weakness of the pulse, were very rarely mentioned. In 1 case there was enlargement of the superficial veins of the abdomen; the abscess in this case supervened "very shortly" after a blow over the liver; the patient lived three months, and at the autopsy the liver was found adherent to the diaphragm on the right side; there were no abdominal adhesions; there was some effusion (serous) in the left pleural and in the pericardial sacs. In another case there was repeated epistaxis, and in a third the pulsations of the heart were communicated to the abscess.

Disturbances of the *respiratory system* are quite common. *Dyspnœa* is mentioned as a troublesome symptom in 12 cases, and *cough*, which was not usually very troublesome, however, is mentioned in 8 cases. The existence of râles, usually subcrepitant, is mentioned in a few cases, and occasionally pleuritic friction-sounds were observed. There would seem to be several causes for the disturbances of respiration in cases of hepatic abscess: (1) The pain occasioned by breathing; (2) the pressure of the abscess upward upon the lung; (3) the bursting of the abscess into the lung; (4) the bursting of the abscess into the pleural cavity; and (5) the existence of pleurisy (which may be serous) as a complication.

Disturbances of the *urinary system* are mentioned but three times in the one hundred and eight cases. Once the presence of albuminuria (five per cent.) was noted. The cause of the abscess in this case was supposed to be a wound by a pistol-ball received two years before. It is worthy of note that the spleen was enlarged in this case. The abscess was incised and drained, and the case ended in recovery. In view of the small amount of albumin present and the extreme rarity of the complication, it is probable that its presence was not connected in any way with the hepatic abscess. In only two cases, so far as I can learn, was any careful examination of the urine made to determine the amount of urea present. Both of these cases are reported by Arnaud,[1] and in one one hundred and thirty-five grains of urea were discharged a day; in the other, one hundred and twenty-three. The amount of the other constituents of the urine is not stated, nor is any statement made with respect to the presence or absence of leucin and tyrosin.

Emaciation is probably present, in greater or less degree, in nearly all cases, though it is only mentioned specifically in twenty-one of the one hundred and eight cases; in some cases, however, it is absent. In a case which I saw a few years ago there was scarcely any loss of flesh, and the thick layer of adipose tissue on the back prevented us from detecting the enlargement of the liver, which was in the back part of the right lobe. Rouis, quoted by Frerichs, says that in three cases he had seen great increase of adipose tissue.

[1] Loc. cit.

The evidence furnished by a *physical examination* of the liver is of far more value than the symptoms in cases of hepatic abscess. Of the eighty-nine cases in which the symptoms are given in some detail, *pain and tenderness* are mentioned as prominent in fifty-six; in four there was tenderness without pain; in two there was complete absence of both pain and tenderness; in the others no mention is made of pain one way or the other.

The character of the pain varies: sometimes it is quite steady; at others it occurs in paroxysms. The seat of the pain is also different in different cases, and seems, as a rule, to depend upon the direction in which the abscess is pressing; if it is pressing upward against the lung the pain is usually under the right scapula or in the right shoulder, though this does not always occur. Thus, in a case reported by Arnaud, the abscess pushed the lung upward very considerably, and yet there was no pain in the shoulder or scapular region. If, on the other hand, the abscess is on the under or front surface of the liver, the pain is usually in the epigastric or hypochondriac region. We have already seen, however, that pain may be entirely absent in such cases, even where adhesions have formed or are forming.

Enlargement of the liver, to a greater or less degree, is present in nearly all cases; it is usually sufficiently great to be plainly evident on palpation and percussion. Of the eighty-nine cases in which the symptoms are mentioned in detail, enlargement was named in sixty-three, and it was probably present in nearly all the others, for in some of them fluctuation is mentioned, and in some aspiration was practised and revealed the presence of pus. In three cases the enlargement was said to be slight; in two of these three cases the abscess was due to dysentery which had first appeared in one case two weeks and in the other three weeks before the abscess became apparent, and was incised. In the other case it was due to a blow; the abscess symptoms appeared four days after the injury, and incision was practised twenty-eight days after.

In two cases it is distinctly stated that the liver was not enlarged; one of these cases was due to dysentery, and the abscess itself was large and single; in the other there were multiple abscesses following obstruction of the bile-duct.

In one case attributed to ulceration of the cervix uteri the liver was contracted by "fibroid material."

The situation of the enlargement depends on the part of the liver involved; in the great majority of cases it is on the right side and it seems to pass upward into the chest and downward into the abdomen in about an equal number of cases. Sometimes, when the swelling can scarcely be perceived or even felt—owing to the tension of the muscles—when the patient is lying down, it becomes very evident when he stands or sits up, the epigastrium and the right hypochondrium then bulging out

very markedly; this occurs even when there are close adhesions, as in a case I have recently seen. In the case of very large abscesses the swelling may extend down to the crest of the ilium, as in a case in my own practice, which I have heretofore mentioned, and in a case reported by Hazzard, in which the enlarged liver extended upward to the third rib and downward to four inches below the ribs.

Fluctuation was only mentioned in eight of the cases which I have tabulated; and in very many cases, no doubt, it is absent in consequence of the distance of the abscess from the surface, or obscured by the condition of the abdominal walls or by tympany.

Aspiration is spoken of by most writers on the subject as a certain test of the existence of an hepatic abscess, and in the great majority of cases, certainly, in which it has been tried pus has been withdrawn, if it was present. But there are two conditions, at least, in which pus may be present and aspiration fail to reveal it: (1) The needle may not enter the abscess; (2) the contents of the abscess may be so thick that they cannot flow through the needle; this fact has been previously mentioned in speaking of the contents of hepatic abscesses and need not be dwelt upon now, further than to say that it would seem that the contents of dysenteric abscesses, and it would perhaps be fair to say those due to amœbic dysentery, are sometimes thick at a very early period. In addition to the cases mentioned by Councilman and Lafleur, in which aspiration gave a negative result, Geschwind reports one due to dysentery, which preceded the abscess by only two weeks, in which very little pus was aspirated, though three-fourths of a litre was discharged on incision.

I do not find any record of a failure to get pus when the needle entered the abscess in any except dysenteric cases, unless the abscess was of old date, and its contents had undergone caseous degeneration.

The *complications* of hepatic abscess are quite numerous, but with the exception of dysentery, localized peritonitis and consequent adhesions, and those connected with the pleura and lungs, they are rare.

The *dysentery*, which is such a frequent complication of the amœbic abscesses, has already been described very fully by Dr. Councilman, and I shall not refer to it.

Nor is it necessary to say much with respect to *peritonitis*. We have already seen that in quite a considerable proportion of cases this complication exists, but in the great majority of cases it is localized and adhesive, and so far from being a harmful matter, it is clearly beneficial when there are adhesions to the abdominal wall, because it removes to a great extent the dangers of an escape of pus into the abdominal cavity, when the abscess is incised. In the same way, also, adhesions to the hollow viscera lessen the gravity of a case in which pus is discharged into the alimentary canal.

Occasionally, however, a *generalized peritonitis* is found, which is not due to the rupture of the abscess into the abdominal cavity. Thus in a case reported by Ridlon,[1] due to ulceration of bowel, there was a generalized chronic peritonitis, and the abdomen contained sixty ounces of fluid; and Hazzard[2] reports two similar cases, one due to dysentery, the cause in the other being unknown.

Hemorrhage from the bowels, or rather hemorrhage *into* the bowels from the cavity of the abscess, is a very rare and very dangerous complication apparently—that is, if any amount of blood is discharged; in many cases, where the abscess bursts into the colon, there is a slight discharge of blood along with the pus, but this slight hemorrhage is only incidental to the rupture, and is not worth calling a complication.

Pleurisy is one of the most common of the complications of hepatic abscess; its occurrence was noted in 11 of the 108 cases. In most cases the exudate was purulent in character, and was then usually due to the rupture of the abscess into the pleural sac, but in some cases the exudate was serous; cases of this kind are reported by Hazzard,[3] Feron and Constan,[4] and Arnaud.[5]

Pneumonia is also an exceedingly common complication, as is apparent from the frequency with which hepatic abscesses burst into a bronchus; in all such cases there is a pneumonia of greater or less extent, but it does not seem to add to the gravity of the case, as a rule; on the contrary, recoveries after rupture into a bronchus are more frequent than after ruptures in any other direction.

Infarction of the spleen is rarely mentioned as a complication of hepatic abscess, and it is of little practical significance at any rate.

Meningitis is also a rare complication, so far as I can determine from the reports which I have examined; it is not mentioned in any of the 108 cases which I have analyzed, though in one of them there was an abscess of the brain. Perhaps meningitis may have been a more common complication formerly, when injuries of the head were said to be a common cause of hepatic abscess.

Caries of the ribs has been noted in several cases. Thus Chauvel[6] reports two cases of this kind, and Byrd has recorded[7] a case of unknown origin in which there was "necrosis of the ribs." The abscess had lasted about nine weeks when this was detected; it was very large, and there was œdema and redness of the skin over an extensive area. A very remarkable case has been reported by Hatch,[8] in which the

[1] New York Med. Journ., April, 1880.
[2] Med. and Surg. Reporter, Jan. 21, 1882.
[3] Loc. cit. [4] Gazette hebd. de Sci. Méd. de Bordeaux, March 6, 1889.
[5] Loc. cit. [6] Gazette des Hôpitaux, 1890, p. 91.
[7] New York Med. Journ., July, 1878. [8] Lancet, January 5, 1889.

whole side sloughed away, and not only the carious ribs, but the kidney was also exposed.

An hepatic abscess may terminate in several different ways:

Absorption is said by some writers on the subject to be of occasional occurrence, but I can find no case of the kind recorded which is at all conclusive. In fact, the term "absorption" has been used sometimes, not to signify the complete disappearance of the pus, but to include its cheesy and calcareous degeneration as well. Thus Frerichs says that in most cases where absorption occurs, a cheesy or calcareous remnant remains. Now this is clearly not absorption in the proper sense of the word, and it does not seem to me proper to include those cases under this heading.

Bursting of the abscess is of comparatively common occurrence. Its actual frequency cannot readily be determined, especially since the propriety of early incision has been recognized, but the statistics of Waring will throw some light on this point. Of the 300 cases analyzed by him, 78 opened spontaneously, 48 were opened artificially, 169 died before bursting or incision, and in 5 the result in this respect was doubtful.

Of the 108 cases which I have analyzed, rupture occurred in 18, 26 died before rupture, and aspiration or incision was done in 59 cases; in 5 there is no distinct record on this point. In addition to the 26 cases in which death occurred before rupture, there were 2 in which one abscess had been incised and drained, but at the autopsy another abscess was found which had not been opened. One patient had abscesses four different times, two of which burst, and two were incised and drained. Another had three different attacks; in the first the abscess broke, the second was incised and drained, and the third was incised, but peritonitis came on and caused death. The interval between the first and second abscess was twenty months, that between the second and third five months. The *direction of the rupture* in the eighteen cases was as follows: Into a bronchus seven times, into the pleura four times, into the colon three times, into the stomach twice, into the abdominal cavity three times, outward through the abdominal walls once, and into the pericardium once. In one case rupture occurred into both the bowels and a bronchus, and in another it occurred into the lungs and peritoneal cavity; in yet another into both the pleural cavity and a bronchus. All the four cases in which the abscess broke into a bronchus only, ended in recovery, and recovery ensued also in the cases in which rupture occurred into a bronchus, and the pleural cavity and a bronchus and the bowel, respectively. Three of the four cases in which rupture occurred into the pleura terminated fatally; in the only one having a favorable termination there was an opening into the bronchus also. Of two cases in which the abscess opened into the bowel only, both died; the third, which opened into a bronchus also, ended in recovery. Both

the cases which opened into the stomach terminated fatally, and all three of those which opened into the abdominal cavity had a similar ending, as would have reasonably been supposed. It will be remembered, however, in this connection, that in one case in which pus escaped into the abdominal cavity when the abscess was opened, recovery ensued.

These cases are too few in number to justify very positive conclusions as to the frequency and gravity of rupture of an hepatic abscess in different directions, but I think one conclusion is fully justified, namely, that rupture into a bronchus, or, as it is often called, rupture into the lung, is the most common and least dangerous direction in which such rupture may occur.

Caseation and *calcification* of its contents are very rare terminations of an hepatic abscess, and are not mentioned in any of the 108 cases which I have analyzed.

Death is a direct result of hepatic abscess, in a large proportion of the cases. Of the 108 cases in my table, 67 terminated fatally—of this number 21 had been either aspirated or incised or drained. 43 cases terminated in recovery, and of these 38 had been either aspirated or incised. The result in three cases is not stated. It will be observed that the total number of *patients* is 108, but the total number of abscesses is 110. This result is due to the fact, previously mentioned, that one patient had three separate and distinct attacks, and another had four. There were two cases, however, in which the result is not stated. Of the 69 fatal cases, the abscesses were multiple in 39 cases, single in 24, and in 4 the number is not stated. If we compare these figures with the general proportion of multiple to single abscesses—42 of the former to 55 of the latter—it is evident that the mortality is much greater in the case of multiple than of single abscesses.

The causes of death are—(1) exhaustion; (2) septic poisoning; (3) peritonitis; (4) destruction of a large amount of hepatic tissue; (5) complications of various kinds other than peritonitis.

It is impossible to get any accurate information as to the relative frequency of the different causes of a fatal termination, because the actual cause of death is so rarely mentioned; but, so far as I can learn, exhaustion is the most serious source of danger, and a slow septicæmia—which, indeed, ultimately causes exhaustion—is next in frequency.

Whatever may be the relative frequency of these different causes of death, however, one thing is quite certain: that, as a general rule, to which there are few exceptions, the longer the abscess remains without a free opening, so that its contents can be easily discharged, the greater is the danger.

The *duration* of the fatal cases was from a few days to six months—the majority died in from six weeks to three months.

The following table will show the mortality of abscesses from various

causes; it will be observed that I do not include all the 110 cases in the table; those which are omitted were due to various causes, such as gastric and duodenal ulcer, peri-uterine inflammation, etc., but the cases attributable to any one cause are so few in number that no deductions can be drawn from them.

		Fatal cases.	Mortality.
Whole number of cases	110	67	60 per cent.
Cases due to dysentery	31	20	62 "
" " injury	12	10	83 "
" " gall-stones	8	8	100 "
Causes unknown	38	17	45 "

The other circumstances influencing the prognosis of hepatic abscess have already been considered as fully as time will permit.

The *treatment* sanctioned by results is so distinctly surgical in character that only a brief outline of it will be given here.

It is scarcely necessary to mention temperance in matters of diet and drink, a pure water-supply, and probably, also, the aseptic management of wounds, as prophylactic measures. I shall not consider the influence of the treatment of dysentery on the occurrence of hepatic abscess, because it has already been considered in the papers on dysentery.

It is very questionable whether any drugs are useful in cases of hepatic abscess, except in so far as they relieve symptoms and aid in the maintenance of the patient's strength.

In view of the extreme difficulty, or, indeed, the impossibility, of determining in a given case whether there is but one abscess or more than one, and in view, further, of the results of operative treatment as compared with expectancy, surgical measures would seem to be indicated in all cases as soon as it is certain that pus has formed, unless the abscess has opened in such a situation that it can discharge freely, and unless the absence of fever, and a general improvement in the patient's condition, give reasonable ground for hope that danger has passed.

In cases of multiple small abscesses, surgical treatment would do no good, but it would as certainly, I think, do no harm; and as it is impossible, as just stated, to recognize the existence of multiple small abscesses by any special symptoms, it seems to me the patient should have the benefit of the doubt, and an attempt at least should be made to find the pus with the aspirator.

Of course, extreme exhaustion would contra-indicate operation here, as in other surgical cases.

The last point to be considered, then, is the different operative measures which have been proposed and their relative value.

The methods which have been proposed and practised are:

1. Aspiration alone.

2. Aspiration and subsequent washing out of the cavity with some antiseptic solution through the aspirator-needle.

3. The use of a large trocar and canula alone.

4. The use of a large trocar and canula, the canula being subsequently left in to secure drainage.

5. Incision.

6. Incision and drainage.

7. Incision and washing out with some antiseptic solution with or without subsequent drainage. But practically these seven may be reduced to three, namely: 1. Aspiration. 2. Incision and drainage. 3. The use of antiseptic washes.

I shall have nothing to say as to the use of Vienna paste before the incision to insure adhesion between the liver and abdominal walls, or of the use of acupuncture for the same purpose, or of stitching of the liver to the walls, etc. These are distinctly surgical measures and do not properly belong in this paper.

Aspiration was practised in 17 of the cases which I have analyzed. Of these 17 cases, 7 ended in recovery, and 10 were fatal. In 4 cases, however, aspiration was followed later on by free incision and drainage, and of these 4, 3 recovered and 1 died. In one of the recoveries, after aspiration the cavity was washed out with carbolic solution through the aspirator-needle.[1]

Incision and drainage were practised in 48 cases, and of these 35 ended in recovery, and 13 were fatal. Of the 35 cases which ended in recovery, antiseptic injections were used in 12; and of the 13 cases which ended fatally, antiseptic injections were used in 2. Of the 35 cases which ended in recovery the abscess was attributed to dysentery in 10 cases; to injury in 2, to an ulcer on the leg in 1, and in 22 cases the cause was unknown.

The causes of death were as follows: in 5, the presence of other abscesses; in one of these there was an abscess in the brain also; in another the abscess which was incised had healed. In the cases of single abscess death resulted from exhaustion three times, from peritonitis once, from pneumonia once, from waxy degeneration of the liver and kidneys once, and from persistent diarrhœa once. In only one case, that of peritonitis, could the result have been due to the operation.

The value of prompt incision and drainage is perhaps universally recognized now, but I trust the statistics which I have given, dry as they are, may not be without value.

[1] Aspiration is *very rarely* dangerous, but it is not absolutely free from danger. Dr. J. C. Reeve, of Dayton, Ohio, has reported a case in which death occurred as the needle was being introduced, and Dr. Godlee refers to the danger of internal hemorrhage from the needle puncture.

I would refer again, in conclusion, to the statistics on this point of Ferron to which I have previously alluded. In 47 cases of antiseptic hepatotomy for hepatic abscess which he collected, there were 10 deaths which were caused as follows: 5 were due to multiple abscesses, 1 to pulmonary trouble, 3 to complications, and 1 to peritonitis, brought on by a counter-opening fifteen days after operation.

In 39 cases of single abscess, he says death followed antiseptic hepatotomy only once.

Of the 8 cases of multiple abscesses, 5 terminated fatally.

Of the 13 fatal cases there was but one abscess in 7; there were more than one in 5, and in 1 the number is not stated.

The following conclusions, it seems to me, are either warranted or rendered highly probable:

1. That hepatic abscesses rarely occur as a result of injuries or diseases of the bones or other parts of the body, except those directly connected with the portal system of veins, or immediately adjacent to the liver.

2. Ulceration of the bowels is a common cause of hepatic abscess, but neither the morbid changes nor the symptoms are those of simple dysentery. It is probable that in most cases, at least, when the hepatic abscess is due to dysentery the latter disease is amœbic in character.

3. An hepatic abscess may appear in two weeks from the commencement of the dysenteric attack, but the usual time is from four to twelve weeks. It is impossible to say how long a time must elapse after an attack of dysentery before all danger of hepatic abscess is past.

4. Abscesses originating in the bile-ducts and those due to injuries of the liver itself seem to be of comparatively rare occurrence. When due to injury, the abscess usually appears in a few days.

5. Abscesses occurring in connection with general septicæmia or pyæmia are probably nearly always multiple in number and small in size, but in rather more than half of all other cases the abscess is single and comparatively large. Abscesses due to gall-stones, however, are usually multiple.

6. Aspiration occasionally fails to reveal an hepatic abscess, because the needle may not enter it, or the contents of the abscess may be too thick to flow through the needle.

7. There are no means of determining with certainty the presence or absence of adhesions in a given case; pain, tenderness, and œdema over the seat of the liver suggest the presence of adhesions, but are by no means certain proof of their existence. Even the up-and-down movement during respiration of a needle inserted into the liver is not a conclusive proof that adhesions do not exist, as was shown by a case recently under my care.

8. Of the symptoms and signs of hepatic abscess, pain, tenderness,

and swelling in the hepatic region are by far the most important. Fever is present in a large proportion of cases, is intermittent in character, and except in pyæmic cases rarely rises above 102.5° or 103°. Jaundice and ascites nearly always denote the presence of dense adhesions or gall-stones. Dyspnœa and cough are frequently present.

9. It is doubtful whether absorption of the contents of an hepatic abscess ever occurs; bursting is of frequent occurrence, the most usual direction being into a bronchus or the pleural cavity. Under expectant treatment death occurs in a large proportion of cases before bursting.

10. With respect to treatment, free incision and drainage give far better results than any other mode. The results of aspiration are rarely satisfactory, nor is aspiration itself entirely free from danger.

SEROUS CYSTS IN THE CEREBELLUM.

By R. T. Williamson, M.D. (Lond.), M.R.C.P.,
MEDICAL REGISTRAR, MANCHESTER ROYAL INFIRMARY.

Cysts of various kinds are met with in the cerebellum. Thus, there are hydatid cysts, cysts due to the cysticercus cellulosæ, cysts following hemorrhage or softening, cystic tumors, and also a very rare variety of cysts—the so-called simple or serous cysts. A number of cases have been recorded in which post-mortem examination has revealed a cyst in the cerebellum containing clear fluid, and as no evidences of the first five above-mentioned causes have been detected, the cases have been described as simple or serous cysts of the cerebellum of obscure origin.

Gowers and Bastian mention these so-called simple or serous cysts; and cases have been recorded by Sharkey, Hadden, Habershon, and others. All writers on the subject have had great difficulty in explaining the origin of these cysts.

Of course, a cerebellar cyst can only be classed as a simple or serous cyst when the history and pathological examination have failed to reveal any evidence of hydatid, cysticercus cellulosæ, hemorrhage or hæmatoidin crystals, or tumor growth. The object of the present communication is to draw attention to the very great difficulty, if not impossibility, of excluding tumor as a cause of apparently simple cerebellar cysts.

Until a most careful and *minute microscopical examination of every part of the cyst-wall* has been made, one is not justified in excluding tumor and describing the case as one of simple cyst. I have recently met with two cases which seem worthy of brief record from their bearing on this point. In both cases, after careful dissection and fairly complete

microscopical examination, I could detect no evidence of tumor, and looked upon them as cases of simple or serous cysts. But on further examination, though nearly the whole of the cyst-wall presented no evidence of tumor, yet at last a very small patch of new-growth was detected. How small this patch of new-growth may be, the notes on Case I. will show. In this case, nowhere, except at one spot in the cyst-wall, was any evidence of new-growth detected; and the new-growth was a minute oval glioma, measuring only $\frac{3}{32}$ of an inch by about $\frac{3}{16}$ of an inch (about 2.5 mm. by 4 mm.), in the wall of a cyst nearly the size of a pigeon's egg. Further, almost the half of this gliomatous new-growth consisted of bloodvessels. If a tumor can undergo cystic degeneration to such an extent that the only remaining new-growth shall be of the dimensions just mentioned, it does not seem improbable that in some cases the whole of the growth may disappear and only a cyst remain.

When one considers the above fact, it is evident that no cerebellar cyst can be described as a simple serous cyst until portions from *every part* of the cyst-wall have been carefully examined microscopically. It seems probable that in some of the recorded cases of simple cysts a minute portion of tumor-growth has escaped observation; and in the other cases, supposing no minute patch of new-growth has been undetected, it seems not improbable that the cases have been cystic tumors in which the cystic degeneration has been so extensive that the whole of the growth has disappeared. On looking over the clinical history of these cases of so called simple cyst we find that the symptoms have been those of cerebellar tumor—severe headache, vomiting, marked optic neuritis, staggering, etc.—and have increased until the death of the patient.

While not denying the possibility of the origin in other ways, it seems more probable that so-called simple or serous cysts have been cystic tumors in which the cystic degeneration has been so marked that the whole of the tumor-growth has disappeared, or only so minute a portion has remained that it has escaped detection.

Briefly, then, the reasons for this assumption are the following:

1. The history and symptoms have been those of cerebellar tumor.

2. Intra-cranial tumors are especially liable to undergo cystic degeneration when situated in the cerebellum.

3. So-called simple serous cysts are exceedingly rare.

4. In many cases which have been looked upon as simple cysts minute examination has revealed a very small mass of tumor-growth at some part of the wall.

5. Hence, no case can be classed as a simple cyst unless careful examination of portions from *every* part of the cyst-wall has revealed no tumor-growth.

6. The amount of new-growth may be so minute as to measure only

$\frac{3}{32}$ by $\frac{3}{16}$ of an inch in the wall of a cyst nearly the size of a pigeon's egg (and almost half of this portion may consist of bloodvessels).

7. If the cystic degeneration can be so marked that only a patch of new-growth of the above dimensions is left, it seems not improbable that in some cases the whole of the tumor may disappear and only a cyst remain, or the remaining tumor-growth will be so small as to escape detection.

To the writer the above seems the explanation of the cases in which the cysts are found *only* in the cerebellum. The origin, however, of those exceedingly rare cases of multiple cysts occurring in the cerebrum, cerebellum, and abdominal organs is very obscure. The following are brief abstracts of the notes of the two cases above mentioned. (For the opportunity of observing the cases during life and of making the pathological examination I am indebted to the late Dr. Ross and to Dr. Bury.)

CASE I.—G. B., aged twenty-seven years; admitted as an in-patient at the Manchester Infirmary, January 20, 1891, under the care of Dr. Ross.

Previous history: Fourteen months before admission the patient was first troubled with headache. This was mainly frontal and at the vertex. It gradually increased in severity, and was worse at night. Six weeks before admission his sight began to fail; three weeks before admission he became blind. A staggering gait and tendency to fall (?) forward had been noticed for two weeks before he came to the hospital. He had been troubled with vomiting occasionally during his illness. No syphilitic history. Nothing of importance with respect to previous health and family history.

Present state: Patient badly nourished; complains of frontal headache and loss of sight. He is quite unable to stand; staggers whenever he attempts to do so; ataxia is so marked that it is impossible to say in what direction he tends to fall. When in bed he can perform, though feebly, all the movements of his limbs; no rigidity; knee-jerks and plantar reflexes present; no ankle clonus. No paralysis of facial, ocular, or tongue muscles nor of muscles supplied by the motor branch of the fifth nerve. No anæsthesia or analgesia. Patient is unable to distinguish light and shade; pupils dilated; marked double optic neuritis, with many retinal hemorrhages. Nothing of importance was detected on examination of the other cranial nerves and other organs of the body. The pain in the head became worse. The patient passed into a semi-conscious condition; otherwise the symptoms were much the same until his death, about four months after admission. The post-mortem was made by Mr. Taylor, M.A., who kindly gave me the cerebellum and the following notes:

Autopsy.—Permission was obtained for examination of the head only. The membranes of the brain were normal. The floor of the third ventricle formed a cyst-like dilatation just behind the optic chiasma. On section, the third and lateral ventricles were greatly distended with clear fluid. Beyond the results of the distended ventricles nothing abnormal was detected on the examination of the cerebrum. At the lower part of the right lobe of the cerebellum was a large cyst only

separated by a thin layer of nerve tissue from the surface. The cyst contained a clear, straw-colored fluid loaded with albumin. No hydatid hooklets nor scolices detected. No signs of hemorrhage. No evidence of cysticercus. No pus cells, no hæmatoidin crystals.

The cerebellum, pons, and medulla were placed in spirit, and given to me for examination. In the right lobe of the cerebellum was a large oval cavity nearly the size of a pigeon's egg, about $1\frac{3}{4}$ inches in the antero-posterior diameter, by about $1\frac{1}{4}$ inches in the transverse diameter. It was only separated from the inferior cerebellar surface by a very thin layer of nerve tissue. The interior of this cavity was quite smooth, and its wall appeared to be composed of condensed nerve substance. No *distinct and separate cyst wall* could be detected. At the median side of the superior surface of the cavity was a longitudinal depression running in the antero-posterior direction. At the posterior end of the cyst a small portion of the wall, about the size of a pea, had been removed for examination by Mr. Taylor. Most careful examination of the cyst wall at the spot from which Mr. Taylor had removed the small fragment, and an examination of portions of the cyst wall from all other parts, failed to reveal any evidence of tumor, and I concluded that the case must be one of simple serous cyst. On mentioning the fact to Mr. Taylor he informed me that, at the spot from which he had removed a small piece of the cyst wall, there was a very slight elevation—the slightest sessile projection, on naked-eye examination. He shortly afterward sent me a section of this slight elevation. Microscopical examination showed a very minute patch of tumor growth, the dimensions of which were $\frac{3}{32}$ of an inch by $\frac{3}{15}$ inch. This patch was surrounded by normal cerebellar tissue. The new growth was a very vascular glioma; nearly one-half of this minute mass being composed of dilated blood-vessels. Several small cysts were also present in this minute nodule. On microscopical examination the wall of the cyst appeared to be formed simply of condensed cerebellar tissue; there was no separate cyst wall. Nothing abnormal was detected in the pons and medulla.

Case II.—Ellen Mc., aged forty-seven years, admitted as an in-patient at the Manchester Infirmary, under the care of Dr. Bury, September 22, 1891.

Previous history: Patient had been troubled with headache and vomiting more or less for two years previous to admission. In February, 1891, symptoms became much worse, and she began to be troubled with a buzzing in the head like the "rushing of water." After a week's rest in bed she improved; but soon began to suffer from attacks of giddiness. For five months previous to admission there had been marked unsteadiness in walking; vomiting had been very troublesome. Several times she had fallen down, owing to vertigo, and at these times the noises in the head had been louder. Patient had been deaf in the right ear since childhood (middle ear disease following measles); for twenty years no discharge from meatus. Deafness had increased very much during last two months. No history of syphilis and no other points of importance in previous history.

State on admission, September 23, 1891: Patient complains of severe headache (especially in the occiput); of deafness and noises in the ears, like the rushing of water; also, of unsteadiness in walking, and vomiting. She is just able to walk without assistance, but only for a short distance. She is very unsteady, and has a tendency to fall backward.

There is no paralysis of the facial, ocular, or tongue muscles. She can perform all the movements of the limbs. The knee-jerks are present; no ankle clonus; no anæsthesia.

Pupils equal, react to light and to accommodation. Vision, R. 6/XXIV, L. 6/XVIII.

Ophthalmoscopic examination: Slight optic neuritis both eyes. Margins of both discs slightly blurred; discs slightly swollen and of a grayish-red color; vessels tortuous. Changes more marked in right eye.

Patient is troubled with noises "like the rushing of water" in both ears. No discharge from the ears; considerable deafness. Watch heard at distance of four inches on the left side; not heard in contact with right ear, but heard on contact with the skull above the zygoma. A tuning-fork placed on the vertex is better heard in the right ear than in the left. Examination with the ear speculum: Right tympanic membrane completely destroyed; but the meatus and tympanic cavity quite dry and free from pus. Left membrane retracted. The patient is very dull and stupid. Heart, lungs, and urine present no important abnormalities. There is frequent nausea, retching, and vomiting; breath very offensive.

28*th*. Severe headache. Pain at the occiput and at the back of the neck; at times very intense. It was necessary to discontinue the examination of the patient on several occasions, on account of these paroxysms of pain. When the patient shows her teeth, the naso-labial fold is not so well marked on the right side of the face as on the left.

The optic neuritis has become more marked. There is a small hemorrhage below and to the outer side of the right optic disc. Vomiting not so frequent. Since admission the temperature has been between 97° and 98°, except on one occasion, when it rose to 98.4°. Patient fell asleep in the evening, but was found dead in bed at 4 A.M., next morning.

Autopsy (Abstract).—No changes of importance were met with in any of the organs of the thorax or abdomen. Skull-cap and dura mater normal. On removing the brain a thin, translucent membrane, evidently the lower wall of a cyst, was seen at the inferior surface of the right lobe of the cerebellum. On cutting into this membrane it was found that the right lobe of the cerebellum was occupied by a large cyst containing clear straw-colored fluid. The inferior wall of the cyst bulged, and anteriorly came almost in contact with the right facial and auditory nerves (brain lying after removal with base upwards). During life it is very probable that the cyst did press on these nerves.

No evidence of tumor growth could be seen, and the cerebellum was placed in Müller's fluid for further examination. In the contents of the cyst there were no hydatid hooklets, blood-corpuscles, pus cells, or hæmatoidin crystals; also, there was no evidence of cysticercus cellulosæ. The fluid contained a large amount of albumin. The rest of the brain was normal. Base of skull normal. There were no cysts in any other part of the body.

After hardening in Müller's fluid the cerebellum was dissected. The cyst cavity was about the size of a walnut; it was roughly oval in shape, the long axis being in the antero-posterior direction. The wall of the cavity was smooth, except anteriorly, where there were a few slight irregularities. There was no separate cyst wall, the cavity appearing

to be bounded only by condensed cerebellar tissue (as was afterwards confirmed by microscopical examination). Near the posterior part of the superior wall (roof) of the cavity was a small opening a little larger than a pin's-head. This was seen to lead into a second small, flattened, smooth-walled cavity, just above (superior to) the one described.

To the naked eye no evidence of tumor could be detected at any part of the cyst wall, and the cyst appeared to be a simple serous one.

Careful microscopical examination of portions taken from various parts of the cyst wall appeared to confirm this opinion. But after prolonged search a small nodule of cystic glio-sarcoma, about the size of a pea, was found at the anterior end of the cyst wall. The nodule was $\frac{4}{16}$ of an inch in diameter (6 mm).

As above mentioned, cases of cerebellar tumor, cystic tumors, and so-called serous cysts present the same symptoms during life, and hence differential diagnosis is impossible.

In the case of a cerebellar cyst, in the wall of which there is either no new growth or only a small fragment, it is possible that if the cyst could be punctured and drained like an abscess, temporary or permanent benefit might follow. A small nodule of glioma in the wall might shrivel up after the cyst was drained.

A case is recorded in the *Berliner klinische Wochenschrift* (July 28, 1890), by Oppenheim and Koehler, of paralysis of the left side of the face and total paralysis of the left arm, with diminution of sensibility. There was a history of Jacksonian epileptic attacks preceding the paralysis, which had come on gradually. An operation was performed, and a cystic cerebral tumor (glioma) was found in the right motor area of the cortex. The contents of the cyst (clear yellowish fluid) were evacuated and only the superficial part of the growth removed, and the cavity drained. Rapid improvement occurred. The movements of the left arm became almost normal, and the patient was discharged from the hospital, well, three months after the operation.

As above mentioned, cystic degeneration is much more frequent in cerebellar tumors than in tumors at other parts of the brain. Hence, in a given number of cases, presenting during life symptoms of cerebellar tumor, the lesion in a considerable number—though, of course, in a minority—will be of a cystic nature; either a cystic tumor or a cyst, in the walls of which only a small fragment of tumor or no new-growth whatever is present.

Hitherto operations for the *removal of cerebellar tumors* have been extremely unsuccessful. It is worth considering, however, whether it might not be justifiable, in *some* cases presenting symptoms of cerebellar tumor, to trephine the skull, and puncture the cerebellum with a fine hypodermic needle, in the hope that the lesion is one of the cystic conditions just mentioned; and if fluid were obtained, to drain and treat as an abscess. This, of course, could only be thought of—after the

failure of medical treatment—in cases the history and symptoms of which rendered a tubercular or syphilitic tumor improbable, preferably in cases in which there was some indication of the side affected. It would only be in the cases of cyst, cystic glioma, and glio-sarcoma (cystic sarcoma?), that there would be any probability of success. But as trephining and puncture with a fine hypodermatic exploring needle (under strict antiseptic precautions) would not be a very formidable procedure, and as the cases are otherwise hopeless, it does not seem very objectionable. In the majority of cases the growth would be solid; but with strict antisepsis probably no grave results would follow. In a minority of cases, however, *the lesion would be cystic* (one of the forms above mentioned); if such were found to be the case, drainage, as in Oppenheim and Koehler's patient, might be followed by good results. The prospects of success, of course, are slender; but, as otherwise the cases are hopeless, the above appears to be a point worthy of attention, when one remembers that lesions of a cystic nature have been found in the cerebellum in a considerable number of cases. The rare cases in the cyst wall of which there happened to be only a small fragment of tumor growth, or no new-growth whatever, would be most hopeful.

THE TREATMENT OF ACUTE DYSENTERY BY ANTISEPTIC RECTAL AND COLON IRRIGATION.[1]

By W. W. Johnston, M.D.,

PROFESSOR OF THEORY AND PRACTICE OF MEDICINE, MEDICAL DEPARTMENT OF THE COLUMBIAN UNIVERSITY; CONSULTING PHYSICIAN TO CHILDREN'S, GARFIELD, AND EMERGENCY HOSPITALS, WASHINGTON, D. C.

The history of the rectal treatment of dysentery is a very interesting one, but I must resist the temptation to enter upon it. It dates back to the Egyptians, Greeks, and Romans, and had alternations of a century of favor followed by centuries of disfavor and abuse. The ancients employed it for the removal of "acrid humors," which, they thought, by their retention intensified the inflammation, and to this same idea have we come again with the help of fifty years of microscopic and chemical study. Coming down to recent years there is one period in the history of this treatment to which I must refer.

Irrigation with Cold and Warm Water.—It is a matter of some interest to *us*, that a physician of the neighboring and historic town of Bladensburg was the first to recommend cold-water injection in dysentery. In the *Edinburgh Journal of Medicine*, in 1826, Dr. Joseph Kent, of Bladensburg, wrote that since 1823, he had employed ice-water injections for dysentery at half-hour intervals, "speedily

[1] Read before the Association of American Physicians at Washington, May, 1892.

alleviating every distressing symptom." In 1848 Assistant-Surgeon Withecomb, in a Calcutta medical journal,[1] reported two cases successfully treated by high injections with a long tube. But it is to the published opinions of Drs. O'Beirne and Hare, that special attention should be paid. O'Beirne, in an article on "New Views of the Process of Defæcation" (Am. ed., Washington, 1834, p. 35), held that in dysentery, "the chief curative indication should be to pass up the gum-elastic tube and introduce it into the sigmoid flexure, in order to give exit to the accumulated and pent-up contents of the cœcum and colon." In an appendix he writes: "Dysentery having reappeared in this city (Washington), I have had opportunities of trying my novel mode of treating the disease." One to four pints of warm water with castor or olive oil were thrown in: hardened feces, mucus, and flatus were passed, with relief of the symptoms.

Hare[2] used these words, full of meaning to us now: "The substance of the whole argument is this—the long tube changes a huge internal abscess into an external one, and enables us to wash out and cleanse from it its putrid contents. It also enables us to foment and soothe by local applications the sloughing and ulceration these contents have caused on its surface. . . . Dysentery in its primary nature . . . is a mild and harmless disease, and . . . therefore if we remove quickly these acrid secretions we shall disarm dysentery of its terrors." He advises the physician not to cease repeating the injection until he is satisfied that the colon is evacuated and cleansed; it is as necessary to wash out the colon when its contents are liquid as when they are solid. "By passing an elastic tube beyond the sigmoid," he says, "I have found in more than three hundred cases of the severest form of dysentery not the slightest difficulty in washing out the colon from cœcum to anus. . . . In treating three hundred and forty-six cases in Calcutta, I had but 4¾ per cent. of deaths."

It is a matter of some little pride to us that two of the three or four who first demonstrated the value of this mode of treatment should have been so near to us—the one our near neighbor, employing iced-water injections, and the other a surgeon of the army residing in Washington, advocating and using irrigations with large quantities of warm water thrown into the sigmoid flexure, with a view of cleansing and washing out the bowel.[3]

[1] India Reg. Med. Sci., Calcutta, 1848.

[2] Edinb. Med. and Surg. Journ., vol. lxxxii., 1849, p. 40.

[3] Cold-water injections or irrigation have also been advised by Baker (1825), Dulles (1877), Messemer (1878), Dagand (1879), Laporte (1879), and Simon (1886).

Warm or hot water has been advised and used by Irving (1849), King (1872), Reid (1876), Kingsley (1887), Graham (1887), and Fordyce (1886). By some of these writers water irrigation was used as a preliminary step to the injection of drugs in solution.

ANTISEPTIC IRRIGATION.—As far back as 1774, we have records of efforts to modify the putrescence and gangrenous destruction of tissue by antiseptic injections.[1] Peruvian bark, chamomile flowers, calumba, charcoal, chloride of lime, hyposulphite of soda, creasote, and other substances have been employed for the purpose by various physicians from that date until the introduction of the more successful antiseptics of the present day. In 1879 Cantani,[2] after treating of rectal alimentation, speaks of disinfecting the colon in dysentery and other diseases by such drugs as carbolic acid, salicylate of soda, borate of soda, etc., and predicts a great future for this kind of treatment.

Two causes have coöperated to draw renewed attention to rectal and colon antisepsis; one is the growing belief in the specific and contagious nature, with the recent discovery of the amœba, of dysentery; the other is the dissatisfaction with other methods and the effort to find in this disease a direct, rational, and successful treatment.

I will not refer to all that has been written on this subject, but for three or four years past the journals have contained some favorable reports of this method. It will be noted, however, that few of them refer to *irrigation;* injection is the usual plan.

The latest communication is one that I have had translated since this paper was written. It is by Dr. Korytin,[3] a Russian. He refers to Dr. Strhogloo[4] as having published, five years before, the results of his treatment of washing out the bowel with a 5 per cent. solution of carbolic acid. Sixteen cases are reported with excellent results. Dr. Kamper in the same year reported the same method used in eighteen cases. Korytin employed warm water or warm carbolized water. One tube only was used and the fluid (six pounds) was allowed to remain in the intestine five to ten minutes, even fifteen to twenty minutes. One to three washings were generally sufficient; sometimes four to six were given, never more than one daily. Nine of the cases were severe (diphtheritic); six were milder (catarrhal). The improvements noted after the injections were: the number of the stools diminished; the frequent desire lessened; appetite, sleep, and the nervous state were all improved. The feces became thicker, lost their foul smell, and the mucus, blood, and particles of waste tissue disappeared; the fever subsided. In the mild forms the results were happiest. In them tepid water had as good an effect as the carbolized warm water. The history of each case is given in detail, showing that the improvement followed immediately upon the washing of the rectum, and that relapses due to its suspension were arrested at once by a return to the treatment.

[1] Pringle: Obs. on the Diseases of the Army, 7th ed., London, 1774, p. 275.
[2] Presse Méd. Belge, Brux., 1879, xxxi. 275.
[3] Vratch, 1890, xi. 957. [4] Russkaia Meditsina, 1884.

In one fatal case after irrigation, the stools were from twenty to five daily; tormina and tenesmus lessened, but the patient grew weaker and died; gangrenous lesions in the bowel were found. In many of the cases internal medication was tried, proved ineffectual, and recourse was then had to the washing. The duration of the case after beginning the treatment was three, and in the most severe cases, seven days.

The strong arguments for the superior advantages of antiseptic irrigation are found in the complete and successful manner in which it answers to the pathological conditions of dysentery: an intense inflammation, seated in the rectum, sigmoid flexure, and colon, and always more intense here, even when the disease extends higher up, characterized by gangrenous destruction of tissues and ulceration with decomposition, and accompanied and most probably due to bacterial multiplication. If these conditions existed *outside* the body there would be but one course followed; the removal of the cause, if possible, then cleanliness and thorough antisepsis. Within the intestinal canal the typical treatment would be the removal of the cause or contributing cause, and cleanliness by thorough flushing of the bowel and antisepsis. There can be, there *must* be but this one principle of treatment, and if the mechanical difficulties involved are removable, it must be the *successful* treatment.

There is one feature in dysentery to which I wish to draw separate attention. It is this: The rectum and colon form a distensible cavity and are closed below by the sphincter. In dysentery this cavity, especially its sacular and most dilated lower portion, becomes the most distended, the most filled by the contents, which are composed of transuded serum, blood, decomposing shreds of tissue, and the results of digestion, the whole being in an active state of disintegration and filled with multiplying bacteria. The sphincter as a result of neighboring inflammation and œdema, acquires great irritability, dilates frequently, but with irregular and spasmodic movement, and contracts quickly and violently, closing the orifice before the rectum is completely emptied. Thus the rectum becomes like an acutely inflamed bladder. A certain quantity of its contents is expelled; a residuum is always left; in some cases the amount is small, in others—bad cases with much fluid—it is large. The rectum is never emptied, but always contains some fluid in a state of active decomposition. In this condition, as in a distended bladder full of decomposing urine, the first indication is to empty the rectum, and the second to wash out the cavity and to keep it empty and clean.

If this statement which I make is true, it has a most important bearing on the nature of dysenteric symptoms and on the kind of treatment which they require. I have found no reference to the fact in any work on medicine or in any medical contribution on the subject, although, in the enormous mass of literature on dysentery, the failure to find such a reference might well be excused. That it is a fact, I have demonstrated

in several cases to my own complete satisfaction, and although it may not be an essential feature in all cases, yet in a large number and those the most severe, it is a constant condition.

The patient whom we see straining at intervals of a few minutes in his violent efforts to empty the rectum, does not empty it, the very intensity of the muscular contraction defeating this object. The sphincter shares in the irritability of all the rectal muscles, and closing spasmodically shuts off the escape of the contents before the act is accomplished. The result is also in part brought about by the patient lying down while straining, and the more feeble from prolonged illness he is, the more likely is the rectum to be incompletely voided. Moreover, the routine treatment in dysentery helps to aggravate this retention; opium suppositories paralyze expulsive muscles but do not relax the sphincter; the number of actions is lessened and they are smaller, but the dangers are increased in proportion to the apparent success of the treatment, and the more severe the case and the more energetic the treatment, the greater is the danger. In graver forms we have the more abundant, dirty white purulent and fetid stools, and the reddish-brown fluid with floating shreds of diphtheritic dysentery. The abundance of fluid favors its retention and accumulation, and every opportunity is given for the absorption of poisonous materials and systemic infection. Under such circumstances can any course seem more unreasonable than the ordinary treatment adopted, and can any course be reasonable except one which applies general and accepted principles to the peculiar physical conditions of dysentery? *Keep the colon and rectum empty and clean;* that is the law and the whole gospel.

The following are two illustrative cases:

Case I.—Miss S. was taken ill on the night of May 28th, with an attack of severe abdominal pain and so-called diarrhœa. Paregoric was given at intervals then, and on the 29th, 30th, and 31st, the actions becoming more frequent, smaller, and showing blood. I was sent for in the night of the 31st. She was suffering intense pain, and was much exhausted by frequent rising to stool; I gave a hypodermic injection of morphia and stimulants internally, and suppositories of morphia were ordered.

June 1st. Some nausea and vomiting. Two actions, reddish in color and offensive, of thickish fluid about two ounces each time. Stimulants, liquid food, and poultices to the abdomen ordered, and a saline purge as soon as she could take it. By the afternoon she had taken two purgative doses, and had had four stools, the last more fecal in appearance with a small scybala, but containing some blood.

2d. Had a moderately good night; two suppositories used. Three small stools, brownish fluid containing some blood. Champagne, milk, and whiskey during the night. During the day she had three stools of reddish-brown fluid with tenesmus; pain in the rectum and abdominal pain. At night she was worse and more nauseated. The actions were

more frequent, consisting of a small amount of fluid, like uncooked beef-tea, passed with tenesmus and causing vomiting.

3d. The stools occurred every hour, and were of the same character, fluid, offensive, and reddish. The desire to empty the rectum and the burning pain in the anus were constant. She had every indication of being weaker and more ill than before. A soft-rubber tube was passed into the rectum and about two ounces of fluid of the same character as had been passed before, flowed out through the tube. A smaller soft-rubber tube was passed by the side of the escape tube, and the rectum was irrigated with a continued stream of warm water with dissolved boric acid, until the water ran perfectly clear. A suppository of a quarter of a grain of morphine was then introduced.

During the day from this time on there was no action. At 3 P.M. the tube was again passed and about one ounce and a half of fluid of the same character escaped. Irrigation as before, and suppository introduced. At 10.30 P.M. there had been no stool and the patient was much stronger in pulse and manner; had had no nausea, and had taken a good deal of nourishment, chicken broth and milk and brandy. Tube then introduced and escape of fluid as before; irrigation and suppository. During the night she was comfortable, and there was no action until 7 A.M. Two suppositories were used.

4th. There were two irrigations practised during the day with the same result as yesterday. The rectum was first emptied of a small amount of fluid, more brownish than before, then washed out, and a suppository introduced. There was nothing else passed from the rectum all day. The night was comfortable.

5th. A dose of oil was given as there had been no action; this produced six actions during the day, four contained some solid matter and the last two were thin and brownish; there was no blood. No irrigation to-day in consequence of the frequent actions.

6th, and for three days after, the rectum was washed once daily; there was no pain or diarrhœa, and her general condition continued to improve daily.

The two points in this case I would draw attention to are:

First. The fact that the rectum was not emptied voluntarily, although the stools were frequent on June 2d and 3d; and, second, that the complete evacuation of the rectum and the antiseptic irrigation at once relieved the distressing symptoms, both local and reflex; thenceforth the patient had no escape of fluid from the rectum except through the tube—that is, no action of her own assent or volition; the morphia, of course, contributed to relieve the irritability of the rectum and sphincter.

CASE II.—Mrs. Y., an elderly woman, of about sixty-five years of age, who had had a dysenteric attack in 1889, was taken with symptoms of extensive colitis in July, 1890. The chief symptoms were fever; feeble pulse; coated, dry tongue; no abdominal pain; frequent fluid evacuations, two to four ounces each time, of a dark-brown, very offensive fluid, containing small masses and shreds of mucus and a very little blood. She tried to resist the frequent desire, but every half-hour to an hour the anus would open and discharge and then spasmodically close

with pain and burning. I tried for three days to relieve her by giving opiate suppositories combined with liquid food. But she made no change for the better, and finally I succeeded in inducing her to let me try a thorough washing of the rectum. I brought her to the edge of the bed in the position for a dorsal uterine examination, and introduced a small bivalve vaginal speculum into the rectum. This was done gradually, without causing much pain. Several ounces of the same ill-smelling fluid escaped from the rectum when the sphincter was relaxed. The rectum was then thoroughly washed out with a five per cent. solution of carbolic acid. All other treatment was suspended. There was an immediate relief to the tenesmus and to the constant and uncomfortable desire to evacuate the rectum. The bowels were not moved until the following day, the discharge being of the same character but less in quantity and less offensive. From this time the rectum was cleansed twice daily for four days; the voluntary stools ceased, the fluid washed out contained mucus shreds, and without a purgative normal fecal matter was passed after the third day's irrigation.

In this case the situation was continued rectal and colon inflammation with beginning ulceration and retention of the decomposing fluid in a distended rectum, consequently increasing danger of infection. The treatment was followed by immediate good.

I will add no words of argument to these facts, which so clearly show the uselessness, the waste of time in mouth-treatment by drugs, and the rational application of a simple and obvious principle to the relief of a local disease.

Methods of Irrigation and Antisepsis of the Colon and Rectum.—In the earlier methods of rectal and colon treatment, water was thrown into the bowel, retained for a certain time and then expelled. Some of the most excellent results are reported from this plan and within recent date. But this cannot but be an imperfect way of cleansing the bowel, although it answers well enough for bringing an antiseptic fluid in contact with the wall of the bowel and with germ-breeding mucus. The objection to it is, the necessity of distending the inflamed coats of the bowel up to a point where injury may be done, if any considerable quantity of water is injected; its advantage is that by this distention the antiseptic fluid washes the inner wall more thoroughly than without it. The method is better fitted, therefore, for subacute cases or those tending to become chronic, than for the acute inflammation with necrosis of the mucous coat. Properly speaking, this method is not irrigation at all, and the only procedure deserving of this title is that in which there is a *free* and *immediate escape* of the water thrown in; and even without argument, it is apparent that in this way only can the bowel be thoroughly emptied and made aseptic.

The mechanical difficulties are very much greater in the efforts to irrigate the colon than in the case of the rectum. To wash the *rectum*, a double, in-and-out, hard-rubber tube, passed into the rectum five to

eight inches, through which flows a current of water from a fountain syringe, answers the purpose well. The only objection is the pain which attends the introduction of a hard, inflexible instrument through the irritable anus. Two soft-rubber tubes passed side by side, the larger one for the escape current, are more comfortable for the patient and better in every way; No. 17 English (29 French) is a good size for the smaller tube, the escape tube can be two sizes larger. A large-sized soft catheter will do very well for the entering current. The double-current soft-rubber tubes are not so successful; their soft and thin walls are pressed upon by the sphincter and escape of fluid is obstructed. Then again there is an advantage in having two separate tubes, as either can be pushed up or down as it is desired to wash different parts of the rectal wall; they are, therefore, to be preferred to any double-current tube. The disagreable sensation of distending the anus passes away in a few moments and the patient gets so much relief from the operation that he ceases to object; preliminary cocaine application may be used if the suffering is great.

All that is needed, then, for this operation are a fountain or Davidson syringe, attached to a small rubber tube or large silk catheter, an escape tube of large size of soft rubber, made long enough by the attachment of a long piece of tubing, so that the fluid escapes into a vessel on the floor. The hand holds and guides the tubes and changes their position from time to time.

The *colon* cannot be distended with water or irrigated with the same facility. That water can be made to pass through the sigmoid flexure there can be no doubt; but the passage of a tube through the flexure into the colon is a difficult task. If this is tried on the cadaver with the abdominal wall removed, one can see how difficult it is; the end of the instrument must describe a complete sharp curve on itself, as if it were about to tie itself into a knot. Even with the hand pressing on the passing instrument and guiding it, it is not easy to accomplish. It is clear from the experiments which I have made, that a partially flexible tube, like the old-fashioned stomach tube, should never be used, and that a small tube does not pass as readily as one which more nearly fills the bowel. Distending the rectum with water as the tube advances, does not favor the passage as much as leaving the bowel empty. The tube finds its way better along the mucus-covered mucous coat. I speak now only of experiments on the cadaver, when the eye is watching the process; the contrary is the general opinion of physicians from efforts on the living patient. But the turning of the instrument on itself in a cavity filled with water, when the end strikes against the wall is very likely to happen and can easily be mistaken for the onward progress of the instrument. In the rectum the finger introduced discovers the error of direction, but higher up it is not possible to do so.

The conclusion of many trials must convince anyone that the attempt to make the instrument enter the descending colon as often fails as succeeds. The difficulties show that all colon irrigation must be done by one tube. I have tried the double-current stomach irrigator and have had constant failure—the closure of the lumen from twists of the tube or from outside pressure prevents the exit of the injected fluid; so that the only way in which this can be accomplished is to force half a pint or one pint of fluid into the colon and then allow it to escape at once through the same tube; in this way the colon and sigmoid can be thoroughly washed out.

What are the indications for the choice of colon or rectal irrigation? In all cases of so-called catarrhal dysentery where the stools are small, contain blood and mucus and in all cases, mild or severe, where the general or local symptoms are relieved by washing the rectum, no attempt need be made to do more than this. For even when the disease extends into the sigmoid flexure and colon, the curative influence is transmitted along the bowel wall upward, as gargling the throat benefits laryngeal inflammation. If the patient continues to have fever, delirium, great restlessness, or other symptoms of general infection, or if stools are large, thin, with a gangrenous odor, containing blood, mucus, and tissue-like shreds, then the attempt should be made to make the tube pass in the sigmoid for higher injection. If the patient is on his left side, with hips raised, a gentle current may pass from a raised fountain syringe into the colon, even if the point of the tube has not passed beyond the first curve of the "flexure." I need not add that there is a danger of perforating an ulcer, even without much force being used, so that the operation should be done with the greatest gentleness. In the great majority of cases of dysentery as we see it, rectal irrigation may, I hope, by continuing experience be proved to be all that we need to gain the desired end.

The *quantity* of water used depends upon the circumstances of each case; as a rule it should pass in and out of the bowel until it runs clear, and both in the case of the colon and rectum the amount thrown in should be equalled or almost equalled by the amount which escapes; if the egress is not free the operation must be stopped until the trouble is remedied. There need be no limit to the quantity of water.

The *frequency* of irrigation is to be regulated by the number of stools, state of decomposition in the bowel, and other conditions; a good rule *is to try to prevent the patient from having any stools at all;* let his bowel be emptied only *at your command* through the inserted tube; at first once in three hours, later three times daily, as the outflowing fluid contains less blood and has less odor. *Keep the rectum empty and clean*, is the one rule.

At first wash the bowel once in three hours; later three times daily,

and so on with diminishing frequency as there are less odor, less blood, and finally less mucus. When mucus is no longer seen in the form of thin flakes the patient may be said to be well; but for a few days one daily irrigation serves a good purpose. Relapses should at once be met by a return to local treatment.

As an *irrigating fluid* water may be used plain, hot or cold, or may contain in solution any of the numerous antiseptics. Extreme cold or very hot water may be injected, but both must have a more or less irritating effect, and their action, in the nature of things, is intermittent. If a continued current of cold or hot water could be kept on the inflamed surface, the case would be different. The surgeon would not apply great heat or cold for five minutes to an inflamed ulcer of the skin and then leave the ulcer alone for three or more hours. It may be practicable to keep water flowing in and out of the rectum for many hours, but few patients could bear such continued distention of the sphincter.

Almost every *antiseptic* has received warm recommendation. Fifty-three cases of acute dysentery were treated at the Military Hospital at Oran with a 1 : 5000 bichloride solution. After the first day the stools were fewer in number, and in three or four days the mucus disappeared; tenesmus and pain were soon lessened.[1]

Lemoine[2] treated fifty-four cases of dysentery with solutions of corrosive sublimate, 1 : 5000. Six ounces were injected into the rectum twice daily; later a solution of the strength of 1 : 3000 was injected twice daily. The fluid was not retained longer than ten minutes. Improvement followed immediately, and acute cases were cured in from one to three days. No systemic poisoning followed in any case.

Notwithstanding all this favorable testimony, the dangers of ulceration in the colon being set up by the remedy, and the grave doubts lately raised as to the value of corrosive sublimate as a germicide in just such conditions as exist in dysentery, deter one from using it at all. Under no circumstances should it be employed without an immediate outlet for the solution.

Tannin destroys bacterial life and renders ptomaines innocuous; it is recommended by Cantani for typhoid fever, and it may have as good an effect in dysentery for the same reason.

Salicylic acid, thymol, aseptol, sulpho-carbolate of zinc, alum, hydrochloric acid, carbolic acid, boric acid, the sulphites and hyposulphites have all been used and advised, but no sufficient number of cases have been treated by any one of these as to lead to its preference over all other remedies of the same class.

[1] Centralblatt f. klinische Medicin, No. 11, 1891.
[2] Bull. général de Thérapeutique, Paris, 1890.

Boric acid and carbolic acid are the only antiseptics I have used frequently; the results have led me to think that the former, or both together, give all we want, and as I believe that a great part of the benefit comes from the cleansing and complete emptying of the rectum, the least irritating and least dangerous germicide ought to be preferred.

A BACTERIOLOGICAL STUDY OF DRINKING-WATER.[1]

By Victor C. Vaughan, Ph.D., M.D.,
of Ann Arbor, Michigan.

Since the opening of the Hygienic Laboratory of Michigan University, October 1, 1888, a large portion of my time, devoted to laboratory work, has been given to the bacteriological study of drinking water. While I have no great discovery to announce to you, I have thought that a brief record of the results obtained after three and one-half years of work might not be wholly devoid of interest. Health officers are given the privilege of sending samples of food and drink to the laboratory for examination, where the work is done for a small fee, which is supposed to cover the cost of material. I have been anxious from the first that this work should be of practical benefit to the people for whom it has been done, and should also constitute a contribution to science.

Having had, before beginning this work, some years of experience in the chemical analysis of drinking-water, and having been convinced of the inadequacy of the evidence furnished by the same, I have entrusted that part of the work, in most instances, to trained assistants, and I am sure that whatever its value may be, the work has been well done. Drs. F. W. Brewer and A. Ives have made most of the chemical analyses, which will be reported in part later in this paper. A small number of the chemical examinations, and all of the bacteriological work, has been done by myself, and I alone am responsible for any errors which may be detected in the same.

We keep at the laboratory a number of sterilized bottles with glass stoppers, and of two and one-half litres capacity. These bottles are sterilized by steam, then set in wooden crates so arranged that the handle of the crate holds the stopper in place, and makes it impossible to open the bottle without removing the handle, which is fastened by means of screws. The use of sealing wax is forbidden, and in cases where the over-zealous collector has resorted to this method "to make things more secure," the samples have been discarded and fresh bottles

[1] Read before the Association of American Physicians at Washington, May, 1892.

have been sent, with the request that the sealing be omitted. In some instances a piece of sublimate gauze has been placed over the stopper and fastened about the neck of the bottle. This admits of the collector placing his seal upon the outside of the gauze. A health officer writes or telegraphs that he wishes one or more samples examined, and the desired number of bottles is sent. He is instructed to fill them and to return them immediately. In the great majority of cases the bacteriological examination has been begun at the laboratory within thirty-six hours after the samples have been collected. In some instances I have instructed the collector to obtain new bottles and to sterilize them, but as a rule this is not satisfactory, and many samples have been discarded on learning the method of sterilization employed; the above-described method is now exclusively used.

Immediately on receipt of the water at the laboratory, gelatin plates are made, and at the same time from two to six beef-tea tubes are inoculated with the water, and placed in an incubator at 38° C. The temperature at which these beef-tea tubes are kept is, as we shall see, a matter of importance. The amount of water added to the gelatin and beef-tea tubes has varied from one drop to one cubic centimetre. My experience has led me to prefer from three to six gelatin plates, each made with one drop of water, to one plate made with one cubic centimetre, provided that in the making of each plate a drop of water is taken up in a fresh pipette after shaking the water in the bottle. I am convinced that in this manner one is less likely to fail to get on the plates all the germs in the sample of water.

After the beef-tea tubes have stood in the incubator at 38° for twenty-four hours, it is observed whether or not any germs have developed, and a record is made of this observation. As we shall see further on, the greater number of the germs found in drinking-water do not multiply at all, or do so very feebly, at 38° C. Whether the germs have developed or not, animals are inoculated with the beef-tea cultures. If certain germs be present, some of the animals thus inoculated will die within a period of time which varies with the animal employed and the method of inoculation. Practically I have used in my routine work, in the majority of instances, white rats. The reasons for selecting this animal are the following: 1. The rat is easily kept and multiplies rapidly, and where one uses from three to four hundred animals in a year, this becomes a matter of some importance. If the animal does not die, it is not used in testing other samples of water, because of the fear that a tolerance for certain water germs may have been established. Some special experiments, however, recently made to test this point seem to show that I have overestimated this danger. 2. As compared with mice, and even with guinea-pigs and rabbits, the operation of inoculation *per se* has less effect upon the rat.

In the routine work, I have usually inoculated the rat by the injection of from one to two cubic centimetres of the beef-tea culture into the abdominal cavity. The reasons for selecting this method of inoculation are: 1. The greater certainty of killing, providing a toxicogenic germ is present, and, 2. the shortening of the length of time between the inoculation and death. These very reasons, however, which have led me to select this animal and the mode of inoculation in making the first rough test of the water, have also induced me to repeat the inoculations, using other animals and other methods of inoculation, in all cases where the results obtained by the routine tests were positive. I will give later on in detail the results of some of these inoculations.

If the animals die, plates are made from the spleen, liver, and kidney in *all* instances, and from the blood in some. The germs which develop on the plates made from these organs are compared with those on the plates made directly from the water, and tube cultures are made of all germs. In the majority of examinations each germ has been studied sufficiently to enable me to identify it. The number of germs on the plates made directly from the water are counted after twenty-four, forty-eight, and seventy-two hours, and as some plates have always been made with one drop of the water, the number on these is given in the table.

I have used the word "toxicogenic" in referring to those germs found in drinking-water which prove fatal to inoculated animals. I have also elsewhere employed the same term in referring to certain other germs. The word toxicogenic (poison-producing) explains itself, but it may be asked why I have taken the liberty of coining such a word, and exactly what meaning do I attach to it? How does it differ in meaning from pathogenic? I suppose that all now believe that germs which are harmful when introduced into the bodies of men and the lower animals owe their deleterious effects to certain chemical products which they elaborate. Therefore, all pathogenic germs are toxicogenic, but are all toxicogenic germs pathogenic? The answer to this question depends upon the meaning which one attaches to the word pathogenic. I prefer to use this word in the sense indicated by its derivation, *i. e.*, as disease-producing. Now, there are poison-producing germs which are fatal to man and some of the lower animals which are not known to induce any characteristic symptoms or any specific lesions. They grow and multiply in the body, sometimes with fearful rapidity, and prove speedily fatal. Such are the germs which induce the great variety of symptoms which we designate as the summer diarrhœas of infancy, and which would more properly be called milk-poisoning. In the same class are those germs which cause serious results to follow the eating of sausage, cheese, canned salmon, lobster, etc. These germs, it seems to me, should not be said to be pathogenic, but they certainly are toxicogenic. Now, I find in drinking-water a number of germs differing from one another morpho-

logically and in their growth on various nutritive media, which do not, in the animals upon which I have experimented, induce any specific disease which can be recognized either by symptoms during life or by lesions after death. These germs I call toxicogenic. A germ, in order to be toxicogenic to a given animal, must multiply in the body of the animal and there elaborate its poison. In this way a germ may be toxicogenic to one animal and not to another.

We must distinguish between the germs which kill by virtue of the chemical poisons which they produce outside the body and those which produce chemical poisons within the body. This difference may be well illustrated by some of the water germs. If we allow the white liquefying bacillus of water to grow in beef-tea for some days at the ordinary temperature of a room, and then inject three or four cubic centimetres of the culture into the abdominal cavity of a white rat, the animal will succumb within a few hours. But this bacillus will not multiply at the temperature of the rat's body, and the fatal effects are due solely to the chemical poisons which the germ produced in the beef-tea before the inoculation. The truth of this may be demonstrated by filtering the culture through a Chamberland filter, and it will be found that the same amount of the germ-free filtrate will kill. I would not say that this germ is toxicogenic to the rat, and I have been careful in all of my experiments to avoid mistaking such a germ for those which I, in this paper, designate as toxicogenic germs. In the routine work this danger is avoided by keeping my beef-tea culture in an incubator the temperature of which will not fall below 38° C. Moreover, in order to satisfy myself that even when the germ is grown at this temperature, the fatal effects are not due to poisons generated in the tube, I have injected cultures which have been freed from germs by filtration through porcelain, and have found that six times the fatal quantity of the germ-containing cultures may be injected without fatal effect. Thus one cubic centimetre of a beef-tea culture of bacillus venenosus twenty-four hours old, invariably kills white rats, while six cubic centimetres of the same culture after filtration fails to cause death. It is true that a small amount of poison is produced in the tube, and this probably has some influence in slightly lowering the vitality of the animal, while the germ rapidly multiplies and produces a sufficient quantity of poison to cause death.

With the method of work now understood, I will give the conclusions which I have reached concerning the value of a bacteriological examination of water, and then will close with tabular statements of the investigations upon which these conclusions are based.

Some of the conclusions which have been reached in this study are as follows:

1. Many of the germs found in drinking-water will not grow at the

temperature of the human body. These germs, therefore, are not capable of inducing disease. It matters not how rich a given sample of water may be in these germs, if it contains no others it cannot be said that the water is a source of typhoid fever. The freedom from typhoid fever of communities using such waters seems to justify this conclusion. Such a water may not be, and certainly often is not, a desirable drinking-water. It may be turbid with suspended matter, unpleasant to the taste, and give off a disgusting odor, but there is no evidence that it can cause disease. Several interesting examples of this kind have come under observation. One of these may be mentioned. A certain city of about ten thousand inhabitants took for awhile its public water supply from a shallow lake, the bottom of which was covered with decomposing organic matter of vegetable origin. This water was turbid, unpleasant to the taste, and gave off unpleasant odors, but none of the bacteria in it grew at 38° C. On the other hand, many of the inhabitants of the city took their drinking-water from shallow wells, the water of which was clear, sparkling, and palatable. The well water, however, contained germs which grew abundantly at 38° C., and which were toxicogenic to animals. The use of the lake water in preference to that supplied by the wells was recommended early in the spring of 1891. Some followed the advice, others did not. During the summer and early fall of 1891 there were more than two hundred cases of typhoid fever in the city, and at a public meeting held by the State Board of Health in this place, about the last of October, every physician in the city agreed to the statement that there had not been a case of typhoid fever among those who had used the lake water exclusively. This positive testimony of the physicians was also confirmed by other citizens.

2. Of the germs which grow at 38° C. or at higher temperatures, some are fatal to animals when injected subcutaneously, while others are not. This renders a division of them into toxicogenic and non-toxicogenic germs possible.

3. There is no proof that these non-toxicogenic germs can multiply in the animal body. Indeed, all the evidence which has been gathered so far goes to show that they not only fail to multiply in the bodies of the rat, mouse, guinea-pig, and rabbit, but that they soon die when injected under the skin or into the abdomen. However, this does not furnish positive evidence that they would not multiply in the body of man. For these reasons waters containing these germs have not been positively condemned, though it has been advised in some cases that their use should be discontinued.

4. Some of the toxicogenic germs found in drinking-water produce the same symptoms and the same post-mortem appearances in the above-mentioned animals as are observed after the similar employment of

Eberth's germs. Moreover, their toxicogenic properties, as tested upon these animals, are fully equal to those of Eberth's germs. They will not only live, but will multiply in the animal body. Waters containing these germs have in all cases been condemned.

5. More than one germ obtained from drinking-water grows with an invisible growth on potato.

6. Several germs found in drinking-water will grow on the media proposed by Parietti, Uffelmann, and others, as means of recognition of the Eberth germ.

The results of the examination of one hundred and forty-eight waters are given in the table. The waters are divided into three classes. The first contains those which are supposed to be causing typhoid fever at the time the water is sent, or to have caused the disease prevailing at the time. In other words, the water has been sent on account of the present existence of typhoid fever among those using it. In the second class are those waters which are not supposed to be causing typhoid fever at the time, but which are suspicious on account of unsanitary surroundings, or on account of previous sickness among those drinking it. In the third class are given those waters which have not been suspected of causing sickness, and the sanitary surroundings of which are not said to be especially bad. Several of the third class have been sent for analysis in view of their possible selection for the water supply of cities and villages. The figures given in the chemical part of the table represent parts per million, the chlorine being calculated as sodium chloride. The chemical analyses are much more extensive than shown in the table. I have given the results of the estimation of free and albuminoid ammonia and chlorine, because much importance has generally been attached to these by chemists. In addition to the figures given in the table a record is made of the physical properties, hardness, amount of residue organic and inorganic, sulphates, earthy bases, nitrates, nitrites, and amount of oxygen consumed in the permanganate process. The number of germs in one drop of the water is given. In the column "kind of germ," the figures refer to the corresponding ones given in the descriptive tables of the individual germ, found later on. The germs which are indicated by the letters C, D, and E, are not given in the descriptive tables, because the cultures have been lost through negligence in not transplanting as often as should have been done. I have elsewhere[1] described these germs, and the following is a brief description of them:

Bacillus C rapidly liquefies gelatine, the liquefaction beginning at the surface. It forms gas, is stained by the ordinary agents and by Gram's method. It resembles Eberth's germ in the formation of an invisible

[1] The Medical News, June 14, 1890.

growth on potato, but in no other respect. Some twenty rats were killed with this germ. The minimum fatal amount of the twenty-four hours' culture for white rats seemed to be between ten and fifteen drops. One strange observation was made. Cultures nine or ten days old are apparently less virulent than those only twenty-four hours old. Moreover, the germ decreases in virulence as it is grown in the artificial media, until in about the sixth generation it may be employed in four times the quantity first used without any effect. The post-mortem appearances are quite different from those observed with Nos. 29 and 31, as given in the descriptive tables in this paper. The intestines are reddened, but the liver and spleen are tarry black. Cultures from these organs show numerous liquefying colonies.

Bacillus D is probably not pathogenic, but kills on account of the chemical poisons rapidly developed. Further study of this germ is needed before extended statements can be made concerning it. I can only say that it does not correspond with any germ given in the tables of Eisenberg.

Bacilius E is non-liquefying. It grows slowly in stick cultures, and forms a scarcely visible growth on potato. It decreases in virulence with artificial cultivation, and while none of the other germs in these waters showed any pathogenic properties in pure cultures, beef-tea inoculated with a drop of the water never failed to kill rabbits and rats, while bacillus E in pure cultures frequently failed to produce death. Moreover, after the death of these animals inoculated with the mixed culture, bacillus E was the only germ found living in the organs. The following quotation from my notes will illustrate this: October 28, 1889, a large rabbit was inoculated with sixty drops of beef-tea, to which one drop of the Negaunee public water had been added. October 21, animal found dead at 9 A. M. Post-mortem showed small intestines and mesentery highly inflamed; no other changes observable. Plates made from spleen, liver, and kidney showed pure culture of germ marked "Negaunee." It is possible that this is Eberth's germ, though of this I am not certain. Unless this be the exception, I have not found Eberth's germ in any of the waters.

The waters No. 140 to No. 147, inclusive, I have not been able to classify. When these samples were sent I preferred not to know the source of each water, and asked that they be designated by numbers. Since sending in my report I have twice written asking that I may be informed of the source of each water, but my request has not been answered. Omitting these samples, the remaining one hundred and forty samples are divided into the following classes, according to their supposed relation to typhoid fever. Thirty-three are placed in the first class, *i. e.*, they are waters which were believed to be causing typhoid fever at the time the samples were sent. Forty-four belong to the second

class, *i. e.*, while typhoid fever is not prevailing among those who are using the water, the water is regarded as suspicious on account of the former existence of typhoid fever or on account of unsanitary surroundings. Sixty-three belong to the third class. The first sixteen waters of first class I have elsewhere[1] discussed. In fifteen of these germs toxicogenic to the lower animals were found.

No. 90 in the next belonging to this class: The city of Sault Ste. Marie takes its water supply above the rapids, and ordinarily it is a very pure water. In the fall of 1890, owing to a break in the lock, more than two hundred boats were detained for two days above the lock and in the immediate vicinity of the intake. Some ten days later typhoid fever appeared, and the deaths were reported to be not less than thirty. All the cases appeared within a few weeks, and sample No. 90 was taken at this time. After this first outbreak there were no new cases. Samples 103, 104, and 105 were collected about one month later, and while the disease was still prevailing, but at a time when no new cases were being reported. I have, therefore, placed them in the second class.

No. 92 furnishes a lesson of interest. Typhoid fever was confined to a certain portion of the city. The supply-pipe carrying water to this portion was, I am told, a wooden one. At one point of its course a privy vault had been dug down upon the pipe, and had been used for some years. The wooden pipe, much decayed, was covered in the vault with fecal matter.

Dr. E. P. Christian, of Wyandotte, Mich., sent me samples Nos. 93 and 94, and along with these a sample of milk. The doctor had about thirty cases of continued fever, some of which he designated as typical and others as atypical typhoid. He soon ascertained that the families in which the typical cases existed took their milk from the same dairyman. No. 93 was taken from the well of the dairyman, and in both this and the milk I found bacillus venenosus. In the river water I found the liquefying toxicogenic bacillus. All who had the fever had used the river water, and some of those who drank both the milk and the river water had had the disease in an atypical form, but none of those who did not drink the milk had the typical form of the disease. These observations were reported to me by Dr. Christian after I sent him the report of the examination. My conclusions, as stated in the report, were as follows:

"I regard both the waters and the milk as unsafe. Of the two waters that from the well is the worst both chemically and bacteriologically. The milk was examined only bacteriologically. The poison-producing germ in the well water is identical with that in the milk. I am inclined to the opinion that if the typhoid fever is due to one of the waters, the well water is the one most likely to be the cause. Eberth's germ (the

[1] The Medical News, June 14, 1890.

so-called typhoid fever germ) was not found in any of the samples. This, however, does not mean, in my opinion, that the waters would not cause typhoid fever. I have never yet found Eberth's germ in drinking-water (with one possible exception). The river water probably has changed in character since the sample was taken, but the well water certainly should not be used."

The men who had typhoid fever at Torch Lake worked in a saw mill, which was located on the bank of the lake. The well from which sample No. 95 was taken was at the mill, and near both well and lake was a large privy vault used by the men while at work. Sample No. 96 was taken from a well which was used by these men when not at work, and was more than a quarter of a mile from both well (No. 95) and lake. I knew nothing of these facts until some time after I had reported, as the samples when sent to me were distinguished by numbers.

In Nos. 101 and 102 I could find no toxicogenic germ, although it was believed that these waters were at the time causing typhoid fever. No. 102 was taken from a farmer's well, and one member of the family after another came down with the fever. Whether there were other possible sources of infection about the place or not I do not know.

Sample No. 107 furnishes another illustration of my failure to find a toxicogenic germ in a water of the first class.

Nos. 109 and 110 were from wells from both of which the sick men had been accustomed to drink before coming down with the fever.

Nos. 111, 112, 113, and 114 came from the public water supply of Duluth, in January, 1891, during the prevalence of a very severe epidemic of typhoid fever. I found a toxicogenic germ in only one of the samples. This sample was taken, so the health officer informed me, from a tap in a doctor's office, the occupant of which had gone home some two weeks before with typhoid fever, and, so far as known, the tap had not been used since that time.

Every now and then some one announces a new test, by means of which the Eberth germ can be distinguished from other germs in water. These announcements are founded upon comparisons with a few water germs, or with those which happen to exist in one or two samples of water. None of these tests have been systematically tried with a large number of germs.

One of these tests, proposed by Parietti,[1] is made as follows: To 10 c.c. of neutral bouillon there are added from three to nine drops of the following solution:

Carbolic acid	5 grammes.
Pure hydrochloric acid	4 "
Distilled water	100 "

[1] "Metodo di ricerca del Bacillo del Tifo nelle acque potabili." Rivista d'Igiene e Sanità Pubblica, 1890.

Samples of Drinking-Water Examined in the Hygienic Laboratory of Michigan University.

From October 1, 1888, to May 1, 1890.

No.	Water sent from	Source.	Class.	Free ammonia.	Albuminoid ammonia.	Chlorine.	Number of germs.	Kind of germs.	Remarks.
1	Omaha, Nebraska,	Well	Second	0.168	0.118	129.0	50	No. 13 was found in all the Omaha samples. No. 10 in samples No. 4. No. 1 in Nos. 1, 3, and 4. Nos. 11 and 12 in samples 5, 7, 8, 9, and 10. Undescribed germs were found in samples 2 and 4.	Pure cultures of each of these germs in beef-tea, twenty four hours old, were injected into the abdominal cavity of rabbits and rats. All were without effect.
2	" "	"	"	0.050	0.124	97.0	46		
3	" "	"	"	0.664	0.230	12.0	120		
4	" "	"	"	0.162	0.116	45.0	50		
5	" "	"	"	0.094	0.112	23.0	26		
6	" "	"	"	0.028	0.090	34.0	18		
7	" "	"	"	0.022	0.102	48.0	38		
8	" "	"	"	0.172	0.088	48.0	36		
9	" "	"	"	0.054	0.068	98.0	20		
10	" "	"	"	0.032	0.096	8.0	8		
11	Coldwater, Mich.	"	"	0.270	0.045	8.0	500	Nos. 10, 13, and 16 were found in these waters.	Inoculations of rabbits were without effect.
12	" "	"	"	0.015	0.025	14.0	712		
13	" "	"	"	0.270	0.040	15.0	370		
14	" "	"	"	0.025	0.040	12.0	580		
15	Ida, Mich.	"	"	0.910	0.120	155.0	2000	No. 13	Inoculation of rabbit was without effect.
16	Brown City, Mich.	"	"	0.220	0.096	8.0	400	Nos. 10 and 13.	Inoculations of rabbits were without effect.
17	Kalamazoo, Mich.	"	Third	0.041	0.084	7.0	63	Nos. 10 and 13	" " " " " "
18	" "	"	"	0.020	0.066	7.0	60		
19	Mount Pleasant, Mich.	River	Second	0.094	0.208	79.0	3000	Nos. 10 and 13	Inoculations of rats were without effect.
20	Gambier, Ohio,	Well	"	0.065	0.062	240.0	683	Nos. 1, 10, 11, 12, 13, and 16	Inoculations of all the germs on rats and rabbits were without effect.
21	Allegan, Mich.	"	"	0.206	0.148	33.0	300	No. 13.	Inoculation of rabbit was without effect.
22	Three Rivers, Mich.	"	Third	0.070	0.046	9.0	25	No. 13	Inoculations of rats and rabbits were without effect.
23	" " "	"	"	0.108	0.072	7.0	29		
24	" " "	"	"	0.024	0.054	7.0	22		
25	Allegan, Mich.	Hydrant	"	0.220	0.066	31.0	40	No. 13	Inoculations of rats were without effect.
26	" "	Artesian	"	0.272	0.556	32.0	25		
27	Coldwater, Mich.	Well	"	0.024	0.038	14.0	16	No. 13	Inoculation of rat was without effect.
28	Kalamazoo, Mich.	"	"	0.144	0.058	9.0	280	Nos. 10 and 13	Inoculations of rabbits were without effect.
29	Tecumseh, Mich.	"	Second	0.037	0.078	10.0	40	No. 13	Inoculation of rat was without effect.
30	Ishpeming, Mich.	Lake	Third	0.222	0.418	6.0	455	Nos. 10 and 13	Inoculations of rats and rabbits were without effect.
31	" "	"	"	0.036	0.222	2.0	50		
32	" "	"	"	0.038	0.208	3.0	48		
33	Three Rivers, Mich.	Well	"	0.200	0.036	0.9	30	No. 13	Inoculations of rats were without effect.
34	" " "	"	"	0.060	0.102	0.7	25		
35	" " "	"	"	0.016	0.062	1.0	22		

36	St. Louis, Mich.	Reservoir	Third	0.060	0.210	23.0	8400	Nos. 10, 12, 13, 16, and 20	Inoculations of rats and rabbits were without effect.
37	" "	Pine River	"	0.044	0 320	24.0	1008	Nos. 10, 13, and 16	
38	Climax, Mich.	Well	Second	0.006	0.084	4.5	105	Nos. 10 and 13	Inoculations of rats were without effect.
39	Grand Rapids, Mich.	River	Third	0.030	0.134	10.0	36,000	Bacillus D.	Rabbits inoculated with No. 39 died, while those
40	" " "	"	"	0.024	0 075	6.0	120		inoculated with No. 40 were not affected.
41	Ann Arbor, Mich.	Cistern	First	2.223	0.908	3.0	3000	No. 29	Rats, guinea-pigs, and rabbits inoculated with
42	Negaunee, Mich.	Lake Teal	"	0.228	0.368	30.0	920	In No. 46, germs Nos. 1,	[this germ died.
43	" "	" "	"	0.232	0.460	30.0	1240	10, and 13 were found. In	Rabbits inoculated with bacillus E died; those
44	" "	" "	"	0.296	0.448	40.0	772	Nos. 42, 43, 44, and 45 there	inoculated with the other germs from the
45	" "	Mine.	"	0.312	0.236	140 0	2060	was found in addition to	same waters were not affected.
46	" "	Sand Shaft	Third	0.042	0.120	40.0	772	the above bacillus E.	
47	Mendon, Mich.	Well	Second	0.019	0 048	4.0	25	No. 13	Rats were not affected.
48	" "	"	"	0.020	0.210	34.0	100	Nos. 1, 10, and 13	
49	Dearfield, Mich.	"	First	0.508	0.158	695.0	898	Bacillus C.	Rats inoculated with this germ died.
50	Northville, Mich.	"	Second	1.136	0.732	6.7	1550	No. 13	Inoculations of rats were without effect.
51	Iron Mountain, Mich.	"	First	1.256	1.920	44.0	1500		
52	" " "	"	"	0.384	0 840	20.0	1350		
53	" " "	"	"	0.784	0.960	52.0	1260	Nos. 13 and 31 were	Rats, guinea-pigs, and rabbits inoculated with
54	" " "	"	"	0.904	1.360	16.0	1700	found in all these waters.	No. 31 died.
55	" " "	"	"	0.456	0.944	12.0	850		
56	" " "	"	"	0.464	1.256	28 0	950		
57	Ann Arbor, Mich.	Cistern.	"	0.318	0.262	6.0	120	No. 29	Rats, guinea-pigs, and rabbits inoculated with
58	" " "	"	"	0.492	0.504	9.0	1770		No. 29 died.
59	Rankine, Illinois	Well	"	0.512	0.332	24.0	738	Nos. 13 and 31	No. 31 is fatal to rats, guinea-pigs, and rabbits.
60	Pomfret, Conn.	"	Second	0.104	0.116	4 0	151	Nos. 10 and 13	Inoculations of rats were without effect.
61	Sherwood, Mich.	"	First	0.194	1.160	7.0	4116	No 14	Rats inoculated with this germ were not affected.
62	Soudan, Minn.	Lake	Third	0.144	0.488	3.0	428	No 11 and bacillus E.	Rats inoculated with E died.
63	" "	"	"	0 132	0.488	4.0	459	No. 11	Rats inoculated with No. 11 were not affected.
64	" "	Well	Second	0.120	0.090	2.0	28	No. 11	
65	" "	"	"	0.072	0.124	2 0	4	No. 29	Rats inoculated with No. 29 died.
66	Lake City, Mich	Lake	Third	0.154	0.280	3.0	124	No. 11	Rats were inoculated without effect.
67	Iron Mountain, Mich.	"	"	0.260	0.270	4.5	9	No. 11	" " " " " "
68	Ironwood, Mich.	Well	"	0.176	0.248	9.9	12	No. 11	" " " " " "
69	Ann Arbor, Mich.	Spring	"	0.012	0.016	2.5	0		
70	" " "	"	"	0.044	0.120	4.0	4	No. 11	" " " " " "
71	" " "	"	"	0.050	0 080	6.0	0		
72	" " "	"	"	0.090	0.214	4 0	6	No 11	" " " " " "
73	Leslie, Mich.	Well	Second	0.536	0.840	14.0	104	Nos. 11 and 13	" " " " " "
74	" "	"	"	1.144	0.984	12.5	2940		
75	Ann Arbor, Mich.	"	Third	0.064	0.064	17.0	150	No. 14	" " " " " "
76	" " "	"	"	0.068	0.070	6.0	60	No. 14	" " " " " "
77	" " "	Spring	"	0.124	0.194	3.5	295	No. 11	" " " " " "

Samples of Drinking-Water Examined in the Hygienic Laboratory of Michigan University. From May 1, 1890, to May 1, 1892.

No.	Water sent from	Source.	Class.	Free ammonia.	Albuminoid ammonia.	Chlorine.	Number of germs.	Kind of germs.	Remarks.
78	Three Rivers, Mich.	Well	Third	0.015	0.019	6.288	8 after 72 hours	No. 13	1 c.c. of beef-tea, twenty-four hours old, was injected into the abdominal cavity of rats without effect.
79	East Lake, Mich.	"	"	0.067	0.058	44.74	None	.....	60 drops of beef-tea, twenty-four hours old, were injected into the abdominal cavity of rabbit without effect.
80	Gladwin, Mich.	"	"	0.374	0.044	11.8	63 after 48 hours	Nos. 13 and 14	Inoculation of rat was without effect.
81	Alpena, Mich.	Hydrant	"	0.148	0.37	6.60	22 after 72 hours	Nos. 10 and 13	
82	" "	Spring	"	0.072	0.174	4.64	2880 after 72 hours	Nos. 10 and 13	Inoculations of rats were without effect.
83	Soudan, Minn.	Well	"	0.05	0.156	1.81	6 after 72 hours	No. 14	Inoculation of rat was without effect
84	" "	"	"	0.058	0.132	2.14	3 after 72 hours	Nos. 10 and 13	Inoculations of rats were without effect.
85	" "	" (Artesian)	"	0.076	0.14	2.14	None	.....	Inoculation of rat without effect.
86	Gladwin, Mich.	"	"	0.26	0.102	1.32	10	Unknown	60 drops of beef-tea, twenty-four hours old, injected into abdominal cavity of guinea-pig. Animal died.
87	Imlay City, Mich.	"	"	0.52	0.052	1321.00	98 after 48 hours	Nos. 10 and 13 and unknown	1 drachm of beef-tea, twenty-four hours old, injected into abdominal cavity of a rat. Death in six hours
88	Gladwin, Mich.	"	"	0.526	0.116	21.45	12 after 72 hours	Nos. 10 and 13	20 drops of beef-tea culture, twenty-four years old, injected into abdominal cavity of rat. No effect.
89	Imlay City, Mich.	"	"	0.462	0.102	1328.25	None	.....	Inoculation of rat with negative results.
90	Sault St. Marie, Mich.	Lake	First	0.224	0.168	3.30	2000	No. 28	1 drachm of beef-tea, twenty-four hours old, injected into abdominal cavity of rat produced death.
91	Bay City, Mich.	Hydrant	Third	0.34	0.48	425.70	420	No. 10	Inoculation of rat produced no effect.
92	" " "	"	First	1.00	0.68	465.30	450	No. 31	20 drops of beef-tea, twenty-four hours old, injected into abdominal cavity of rat produced death.
93	Wyandotte, Mich.	Well	"	0.40	0.56	266.4	2430	Nos. 10 and 28	20 drops of beef-tea culture, twenty-four hours old, injected into abdominal cavity of rat produced death.
94	" "	River	"	0.08	0.52	49.5	1770	Nos. 10 and 31	20 drops of beef-tea culture, twenty-four hours old, injected into abdominal cavity of rat produced death.
95	Torch Lake, Mich.	Lake	"	.....	.....	.....	5284	Nos. 10 and 28	20 drops of beef-tea culture, twenty-four hours old, injected into abdominal cavity of rat caused death.
96	" " "	Well	"	.....	.....	.....	2520	No. 10	Inoculation of a rat produced no effect.

97	Torch Lake, Mich.	Well	First	.....	.....	.....	20	Nos. 10 and 28	Injection of 20 drops of beef-tea culture, twenty-four hours old, into peritoneal cavity killed rat.
98	Pontiac, Mich.	Hydrant	Second	0.422	0.574	9.9	23 after 48 hours	Nos. 10 and 13 and unknown	Inoculations of rats were without effect.
99	" "	Lake	"	0.266	0.302	9.075	18 after 48 hours	No. 10	Inoculation of rat was without effect.
100	" "	"	"	0.130	0.35	9.9	12 after 48 hours	No. 10	" " " " "
101	Negaunee, Mich.	"	First	0.024	0.820	6.105	10	No. 10	" " " " "
102	Parma, Mich	Well	"	0.058	0.124	100.65	1234	No. 10	" " " " "
103	Sault Ste. Marie, Mich.	Lake	Second	0.05	0.104	6.6	5	No. 4	" " " " "
104	" " "	"	"	0.06	0.12	8.25	12	No. 4	" " " " "
105	" " "	"	"	0.176	0.16	11.55	150	Nos. 10 and 4	Inoculations of rats were without effect.
106	Bay City, Mich.	Hydrant	Third	0.366	0.38	339.95	350	No. 10	Inoculation of rat was without effect.
107	Pontiac, Mich.	Well	First	0.198	0.368	44.55	240	No. 13	" " " " "
108	Three Rivers, Mich.	"	Third	0.472	0.212	9.90	26	Nos. 10 and 13	Inoculations of rats were without effect.
109	St. Johns, Mich.	"	First	0.094	0.13	18.15	11,025 after 48 hours	Nos. 13 and 28	1 c.c. of beef-tea culture, twenty-four hours old, was injected into the abdominal cavity of each of three rats; one died, two recovered.
110	" "	"	"	0.13	0.122	18.15	6	Nos. 10, 13, 4	Inoculations of rats were without effect.
111	Duluth, Minn.	Lake	"	0.04	0.124	7.2	200	No. 10	1 c.c. of a culture, forty-eight hours old, was injected into abdominal cavity of rat, results negative.
112	" "	"	"	0.058	0.12	8.25	198	No. 10	1 c.c. of a culture, forty-eight hours old, was injected into abdominal cavity of rat; result negative.
113	" "	"	"	0.007	0.264	8.25	20	Nos. 4, 10, 30	1 c.c of a culture, forty-eight hours old, was injected into abdominal cavity of rat; result death.
114	" "	"	"	0.038	0.058	9.075	1	No. 10	Inoculation of rat was without effect.
115	" "	Spring	Third	0.058	0.07	14.85	12 after 48 hours	No. 4	" " " " "
116	Leadville, Col.	From a mine	"	0.094	0.094	3.30	145 after 72 hours	Nos. 10 and 4	Inoculations of rats were without effect.
117	Iron Mountain, Mich.	Well	"	0.444	0.444	4.95	5	No. 10	" " " " "
118	" " "	Hydrant	"	0.57	0.57	4.95	6	No. 10	Inoculation of rat was without effect.
119	" " "	Lake	"	0.342	0.342	4.125	2	No. 10	" " " " "
120	" " "	"	Second	0.11	0.322	6.93	5	No 10	" " " " "
121	" " "	"	"	0.092	0.314	7.09	4	No. 10	" " " " "
122	Gaylord, Mich.	Unknown	Third	0.39	0.98	26.40	670 after 48 hours	No. 13	Rats were inoculated without effect.
123	Iron Mountain, Mich.	"	Second	0.03	0.15	4.0	8	No. 13	Injection of 20 drops of beef-tea culture, twenty-four hours old, into abdominal cavity of a rat produced no effect.
124	Norway, Mich.	"	Third	0.01	0.03	1.0	6	Nos. 10 and 13	20 drops of beef-tea culture, twenty-four hours old, injected into the abdominal cavity of a rat produced no effect.
125	" "	"	"	0.02	0.15	3.0	10	Nos. 10 and 13	20 drops of beef-tea culture, twenty-four hours old, injected into the abdominal cavity of a rat produced no effect.
126	" "	Well	"	0.005	0.01	0.5	6	No. 13	Inoculation of rat was without effect.
127	Adrian, Mich.	Unknown	First	0.03	0.20	10.0	40 after 24 hours	Nos. 10 and 28	20 drops of beef-tea, twenty-four hours old, were injected into the abdominal cavity of a rat. Death resulted.

No.	Water sent from	Source.	Class.	Free ammonia.	Albuminoid ammonia.	Chlorine.	Number of germs.	Kind of germs.	Remarks.
128	Iron Mountain, Mich.	Water works	Third	0.005	0.025	2.0	13 after 24 hours	Nos. 10 and 21	Rats were inoculated without effect.
129	Pontiac, Mich.	Well	"	0.18	0.10	12.0	30 after 72 hours	Nos. 14 and 21	" " " " " "
130	Ironwood, Mich.	River	Second	0.103	0.116	5.6	400 after 24 hours	Nos. 10, 12, 13	" " " " " "
131	Iron Mountain, Mich.	Spring	Third	0.07	0.05	0.42	4	Nos. 10, 25, 26	" " " " " "
132	Ithaca, Mich.	Unknown	"	0.41	0.13	25.0	500 after 24 hours	Unknown.	20 drops of beef-tea, twenty-four hours old, were injected into the abdominal cavity of a rat without effect.
133	Hastings, Mich.	Well	Second	0.20	0.11	18.0	850	Nos. 14 and 15	Rats were inoculated without effect.
134	Iron Mountain, Mich.	Lake	Third	0.15	0.08	1.3	4	Nos. 10 and 3	" " " " " "
135	" " "	Spring	"	0.34	0.106	1.0	2	Nos. 10 and 3	" " " " " "
136	Ithaca, Mich.	Well (deep)	"	0.302	0.24	2.8	None	.....	Rat was inoculated without effect.
137	Holland, Mich.	Water works.	Second	0.068	0.09	13.85	20	Nos. 13 and 14	Rats were inoculated with negative results.
138	" "	Well (deep)	"	0.514	0.166	15.675	180 after 48 hours	Nos. 13 and 14	" " " " " " "
139	" "	Well (shallow)	"	0.088	0.134	6.93	120 after 48 hours	Nos. 13, 14, 20	" " " " " " "
140	Chicago, Ill.	.....	.....	0.310	0.198	11.55	7	Nos. 9, 10, 24	" " " " " " "
141	" "	.....	.....	0.042	0.06	10.395	90 after 48 hours	Nos. 17, 18, 23	" " " " " " "
142	" "	.....	.....	0.31	0.148	14.85	4	Nos. 2 and 11	" " " " " " "
143	" "	.....	.....	0.178	0.166	8.25	6	Nos. 7, 15, 26	" " " " " " "
144	" "	.....	.....	0.44	0.196	10.98	9	Nos 3 and 27	" " " " " " "
145	" "	.....	.....	0.176	0.106	13.20	48 after 48 hours	Nos. 2, 8, 9, 19, and 27	" " " " " " "
146	" "	.....	.....	0.14	0.196	12.705	6	Nos. 2, 7, 10, 15, 19, 22	" " " " " " "
147	" "	.....	.....	0.68	0.24	18.48	5	Nos. 6, 11, 13, 23	" " " " " " "
148	Dunkirk, N. Y.	.....	Second	0.094	0.16	2.478	60 after 48 hours	Nos. 10 and 27	" " " " " " "

The tubes thus prepared are kept in the incubator for twenty-four hours at 37° in order to see that no contamination with germs from the air has occurred. To the tubes which remain clear, from one to ten drops of the suspected water is added, and the tubes returned to the incubator. If the beef-tea becomes cloudy within the next twenty-four hours, one can, according to Parietti, positively conclude that the typhoid germ is present. The excellence of this test has been attested by Kamen.[1]

Of the seven water germs described in the following tables as growing at 38°, every one grows abundantly in Parietti's solution. Of the twenty-four remaining germs, two were not tested and three were found to grow in Parietti's solution. These three are germs which grow feebly at 38° in ordinary beef-tea, and the addition of Parietti's solution did not further retard their growth.

Uffelmann[2] proposes a test by which many water germs can be excluded in searching for the Eberth germ. His medium consists of a citric acid gelatin, colored with methyl-violet. He states that only a small number of germs, other than the Eberth germ, will grow on this gelatin, and that these do not take up the coloring matter like the Eberth germ. Of the thirty-one water germs upon which I have made this test, nine grow, and some of these stain more intensely than Eberth's germ.

I have used the potato gelatin test of Holz,[3] with and without the addition of carbolic acid as is recommended, with all the toxicogenic germs described in this paper, and I find that all grow quite as readily and abundantly as the Eberth germ.

No. 1. *Micrococcus Candicans.*

Form. Large cocci often grouped in clusters, which vary much in size.
Growth:
On gelatin plates. Superficial colonies look like minute drops of milk. The deeper ones are more or less brown and granular.
In gelatin tubes. Grows along the line and forms a "nail head" on the surface.
On agar. A yellowish or brownish growth.
On potato. A white, slimy growth.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature, but not at 38°.
Rate of growth. Rapid.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. White.
Toxicogenic properties. Negative.

[1] Centralblatt f. Bakteriolgie u. Parasitenkunde, B. xi, No. 2.
[2] Berliner klinische Wochenschrift, 1891, No. 35.
[3] Zeitschrift f. Hygiene, B. viii, S. 143.

No. 2. *Micrococcus Aquatilis Albus.*

Form. Small cocci.
Growth:
On gelatin plates. Snow-white dots. Spherical colonies with many irregular forms.
In gelatin tubes. Very slight along the line, and spreading but little over the surface. The growth on the gelatin is not abundant.
On agar. Very slight, white growth.
On potato. Thick directly over the place of application, but spreading very little. The color is yellowish-white.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows slowly at ordinary temperature, and more feebly at 38° C.
Rate of growth. Very slow.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. White.
Toxicogenic properties. Negative.

No. 3. *Micrococcus Aquatilis Magnus.*

Form. Very large micrococci.
Growth:
On gelatin plates. Deep brown colonies, with smooth outline.
In gelatin tubes. Few isolated colonies along the track. Spreads over the surface.
On agar. White, thin growth.
On potato. White or brownish granular growth.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows well at ordinary temperature, and feebly at 38° C.
Rate of growth. Moderate.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. White.
Toxicogenic properties. Negative.

No. 4. *Micrococcus Luteus.*

Form. Small micrococci, growing in zoöglea.
Growth:
On gelatin plates. Sulphur-yellow, granular colonies.
In gelatin tubes. Grows along the line and slowly spreads over the surface.
On agar. A lemon-yellow growth.
On potato. An abundant growth, which is at first dirty white, but which gradually becomes lemon-yellow.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature, but not at 38° C.
Rate of growth. Rapid.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. Lemon-yellow.
Toxicogenic properties. Negative.

No. 5. *Micrococcus Cereus.*

Form. Micrococci.
Growth:
On gelatin plates. Pale, yellow colonies, of smooth outline.
In gelatin tubes. Very slight along the track; spreads slowly over the surface.
On agar. Very faint, white growth.
On potato. Yellowish white, waxy growth. Beyond the border of the growth the potato becomes bluish gray.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature, but does not grow at 38° C.
Rate of growth. Slow.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. White to brownish-yellow.
Toxicogenic properties. Negative.

No. 6. *Micrococcus Subflavus.*

Form. Elliptical micrococci, growing in zoöglea.
Growth:
On gelatin plates. Yellowish-brown, spherical colonies.
In gelatin tubes. Very slight along the track; spreads slowly over the surface.
On agar. White to yellowish-white.
On potato. Pale, yellow growth, with sloping edges.
In Parietti's solution. Does grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature, and feebly at 38° C.
Rate of growth. Moderate.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. Pale yellow.
Toxicogenic properties. Negative.

No. 7. *Micrococcus Aquatilis Invisibilis.*

Form. Oval cocci.
Growth:
On gelatin plates. Deep brown colonies, with smooth outline; spreading irregularly superficially.
In gelatin tubes. Slight growth along the line, but spreading on the surface.
On agar. White, thin growth.
On potato. Invisible.
In Parietti's solution. Does grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows well at ordinary temperature, but feebly at 38° C.
Rate of growth. Slow.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. White.
Toxicogenic properties. Negative.

No. 8. *Diplococcus Aquatilis.*

Form. Diplococci.
Growth:
On gelatin plates. Smooth, pale yellow colonies, mostly spherical, but showing some irregularities.
On gelatin tubes. Growth confined to surface, where it spreads to the walls of the tube.
On agar. Smooth, white growth.
On potato. Dirty white and glazed; thick, with sloping borders.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Does not grow at 38°; grows well at ordinary temperature.
Rate of growth. Moderate.
Relation to air. Aërobic.
Production of gas. None.
Liquefaction. None.
Color. White.
Toxicogenic properties. Negative.

No. 9. *Streptococcus Aquatilis.*

Form. Large micrococci; some single, others in pairs, and some in chains of from four to eight.
Growth:
On gelatin plates. Colonies spherical, many having notched outlines.
In gelatin tubes. Grows very slightly along the line, but spreads over the surface to the walls of the tube.
On agar. Very thin, white growth.
On potato. Heavy, moist, white growth.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Does not grow at 38°; grows at ordinary temperature.
Rate of growth. Slow on gelatin; rapid on potato.
Relation to air. Aërobic.
Production of gas. None.
Liquefaction. Negative.
Color. White.
Toxicogenic properties. Negative.

No. 10. *Bacillus Fluorescens Liquefaciens.*[1]

Form. Very small bacilli; twice as long as broad.
Growth:
On gelatin plates. Small, round colonies, liquefying and sinking into the gelatin.
In gelatin tubes. Liquefies gelatin rapidly from surface evenly to bottom; no scum on surface; deposit heavy and yellowish white. The supernatant fluid is yellowish, with green fluorescence, most marked near the surface.
On agar. Thin white growth.
On potato. Smooth growth, with yellowish tint and sloping margins.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.

[1] I have found two varieties of this germ. The second differs from the one described in this table in the following particulars: 1. In gelatin tubes the liquefaction proceeds slowly, and after half or two-thirds of the gelatin has been liquefied, ceases altogether; the subjacent gelatin showing marked fluorescence. 2. It grows abundantly in Uffelmann's gelatin, and takes the stain more markedly than does Eberth's germ.

Effect of temperature. Grows at ordinary temperature, but does not grow at 38° C.
Rate of growth. Rapid at ordinary temperature.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Liquefies rapidly and completely.
Color. Yellowish white.
Toxicogenic properties. Negative.

No. 11. *Bacillus Fluorescens Non-liquefaciens.*

Form. Small bacilli, with rounded ends.
Motility. Non-motile.
Growth:
On gelatin plates. Glistening, mother-of-pearl colonies, spreading on the surface.
In gelatin tubes. Growth confined to surface, and dirty yellow in color; subjacent gelatin shows green fluorescence.
On agar. White on the surface, while the mass of agar becomes green.
On potato. Grayish white or brown growth, with glistening surface.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows well at ordinary temperature, but does not grow at 38° C.
Rate of growth. Rapid at ordinary temperature.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Non-liquefying.
Color. White, or yellowish to brownish white.
Toxicogenic properties. Negative.

No. 12. *Bacillus Gasoformans.*

Form. Small bacilli, two to three times as long as broad.
Motility. Motile.
Growth:
On gelatine plates. Large colonies, which rapidly liquefy the gelatin.
In gelatin tubes. Rapidly liquefies the gelatin, and bubbles of gas form along the line of inoculation.
On agar. A brownish or yellowish growth.
On potato. Dirty white growth.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature, but not at 38° C.
Rate of growth. Rapid.
Relation to air. Aërobic.
Production of gas. Produces gas abundantly.
Liquefaction. Liquefies gelatin rapidly.
Color. White.
Toxicogenic properties. Negative.

No. 13. *Bacillus Liquefaciens Albus.*

Form. Small rod, with rounded ends.
Motility. Very motile.
Growth:
On gelatin plates. Small, round colonies, liquefying rapidly.
In gelatin tubes. Grows rapidly, and completely liquefies the gelatin.

On agar. A dirty white growth.
On potato. Yellowish or brownish white.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Does not grow at 38°; grows well at ordinary temperature.
Rate of growth. Moderate.
Relation to air. Aërobic.
Production of gas. The gelatin tubes give off no odor, and for this reason this germ must not be confounded with the bacillus liquefaciens, as described by Eisenberg.
Liquefaction. Liquefies rapidly.
Color. White.
Toxicogenic properties. Negative.

No. 14. *Bacillus Albus.*

Form. Short bacilli, often in chains.
Motility. Motile.
Growth:
On gelatin plates. White, smooth colonies.
In gelatin tubes. Grows slowly along the line of inoculation, and forms a white "nail head" on the surface.
On agar. A milk-white growth.
On potato. A dirty yellowish-white growth.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature, but does not grow at 38° C.
Rate of growth. Slow.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Does not liquefy.
Color. White.
Toxicogenic properties. Negative.

No. 15. *Bacillus Albus Putridus.*

Form. Long and short bacilli, often growing in chains.
Motility. Motile.
Growth:
On gelatin plates. Round, white or brown colonies.
In gelatin tubes. Growth confined to surface, where it becomes very heavy. Liquefaction extends downward very slowly. (In these respects this germ differs from that described by Eisenberg under this name.) The contents of the tube give off a highly offensive odor.
On agar. Heavy, smooth growth.
On potato. Slimy, grayish-white; later, brownish growth.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Does not grow at 38°; grows well at ordinary temperature.
Rate of growth. Rapid.
Relation to air. Aërobic.
Production of gas. Gives off putrefactive odors.
Liquefaction. Liquefies slowly.
Color. White, or yellowish white.
Toxicogenic properties. Negative.

No. 16. *Bacillus Violaceus.*

Form. Bacilli about three times as long as broad, often growing in threads.
Motility. Motile.
Growth:
On gelatin plates. The colonies look like small air bubbles to the unaided eye. Under the microscope the colonies are granular and violet. Sometimes the surface of the gelatin is raised like a foam.
In gelatin tubes. Produces a funnel-shaped liquefaction, while the pale violet mass of germs lies at the bottom.
On agar. A blue to violet growth.
On potato. A dark violet growth.
In Parietti's solution. Not tested.
In Uffelmann's gelatin. Not tested.
Effect of temperature. Grows at ordinary temperature, but not at 38° C.
Rate of growth. Moderate.
Relation to air. Facultative anaërobic.
Production of gas. None observed.
Liquefaction. Liquefies.
Color. Produces a violet color.
Toxicogenic properties. Negative.

No. 17. *Bacillus Gracilis Aërobiens.*

Form. Bacilli four to six times as long as broad.
Motility. Motile.
Growth:
On gelatin plates. Small, yellow colonies of rapid growth.
In gelatin tubes. Grows abundantly along the track.
On agar. Grayish-white, feeble growth.
On potato. A waxy growth of pinkish-white color, while beyond the growth the potato becomes steel gray.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Grows abundantly, and stains more intensely than does Eberth's germ.
Effect of temperature. Grows at ordinary temperature; does not grow at 38°.
Rate of growth. Rapid.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. White to gray.
Toxicogenic properties. Negative.

No. 18. *Bacillus Gracilis Anaërobiescens.*

Form. Bacilli three times as long as broad, often growing in long, slender rods.
Motility. Very motile.
Growth:
On gelatin plates. Brownish colonies, spreading irregularly.
In gelatin tubes. Grows abundantly along the line, and also spreads over the surface.
On agar. Thin, white growth.
On potato. Growth is yellowish white, abundant and prominent. Stains made from potato show long threads, with shorter bacilli near, often presenting the appearance of fringe.
In Parietti's solution. Grows.
In Uffelmann's gelatin. Does not grow.

Effect of temperature. Grows well at ordinary temperature, and feebly at 38°.
Rate of growth. Rapid.
Relation to air. Grows under gelatin.
Production of gas. Forms gas abundantly when grown under gelatin.
Liquefaction. Negative.
Color. White.
Toxicogenic properties. Negative.

No. 19. *Bacillus Helvolus.*

Form. Short bacilli, often growing in chains, and frequently forming long threads.
Motility. Only an oscillation.
Growth:
On gelatin plates. Small, yellowish or brownish colonies.
In gelatin tubes. Forms on the surface a spreading white growth, which later becomes yellow. The growth spreads to the walls of the tube, and very slowly sinks in the gelatine as liquefaction goes on. The growth along the line is very slight, or wanting altogether.
On agar. Yellowish white growth.
On potato. Yellow.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows well at ordinary temperature, but only feebly at 38°.
Rate of growth, Slow.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Liquefies very slowly.
Color. White to yellow.
Toxicogenic properties. Negative.

No. 20. *Bacillus Rubidus.*

Form. A bacillus four to six times as long as broad.
Motility. Sluggishly motile.
Growth:
On gelatin plates. Yellowish, irregular colonies.
In gelatin tubes. Slight growth of isolated colonies along the line; these soon become pink in color. The growth at the surface is abundant, and as the gelatin liquefies large masses of the germ, with faint pink tint along the lower border, float in the liquid.
On agar. Faint yellowish growth, with no evidence of the possible development of color shown on some other media.
On potato. The growth has at first a slight pinkish tint, which, with age, develops into a beautiful red.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows well at ordinary temperature, but does not grow at 38° C.
Rate of growth. Moderate.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Liquefies slowly.
Color. Red.
Toxicogenic properties. Negative.

No. 21. *Bacillus Cinnabareus.*

Form. A short bacillus.
Motility. Highly motile.
Growth:
On gelatin plates. Brick-red colonies.
In gelatin tubes. Liquefies rapidly and completely.
On agar. Cinnabar-red growth.
On potato. An abundant growth, at first yellowish-white, becoming more red with age.
In Parietti's solution. Not tested.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature; does not grow at 38° C.
Rate of growth. Rapid.
Relation to air. Not tested.
Production of gas. None observed.
Liquefaction. Liquefies rapidly.
Color. Cinnabar-red.
Toxicogenic properties. Negative.

No. 22. *Bacillus Subflavus.*

Form. Bacilli two to three times as long as broad.
Motility. Motile.
Growth:
On gelatin plates. Small, glistening, white, irregular colonies.
On gelatin tubes. Grows but slightly along the track; spreads over the surface. The tube shows slight fluorescence.
On agar. Yellowish-white growth; with age the mass of agar becomes brownish-yellow.
On potato. A beautiful salmon-colored granular growth.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Grows abundantly, and stains more intensely than Eberth's germ.
Effect of temperature. Grows at ordinary temperature; does not grow at 38° C.
Rate of growth. Rapid.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. Yellowish-white.
Toxicogenic properties. Negative.

No. 23. *Bacillus Ochraceus.*

Form. Bacilli two to three times as long as broad, with rounded ends.
Motility. Non-motile. (In which respect it differs from Zimmermann's germ of the same name.)
Growth:
On gelatin plates. Small, yellow, irregular colonies, spreading slightly over the surface.
In gelatin tubes. Slowly liquefies evenly from the surface; the mass of germ lying on the bottom of the liquefied part, and showing at first a pale yellow, then an orange growth.
On agar. Forms an even yellow growth.
On potato. A beautiful and abundant growth of ochre yellow. This growth is very thick and heavy, and in this respect differs from the germ of Zimmermann.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.

Effect of temperature. Does not grow at 38°; grows well at ordinary temperature.
Rate of growth. Moderate.
Relation to air. Aërobic.
Production of gas. None.
Liquefaction. Liquefies slowly.
Color. Orange to ochre.
Toxicogenic properties. Negative.

No. 24. *Bacillus Figurans.*

Form. Bacilli two to three times as long as broad, but showing marked variation in form. Sometimes they appear as very short bacilli, while at other times they grow into long threads.
Motility. Sluggishly motile.
Growth:
On gelatin plates. The deep colonies are spherical and smooth, but the superficial growth forms curved and interlacing lines, often presenting most grotesque figures. Plates may show no liquefaction after some days.
In gelatin tubes. Does not develop along the line. Generally liquefies from the surface before the growth has reached the walls of the tube. Liquefaction, however, goes on very slowly, and, in some instances, the fluid is lost by evaporation as fast as it liquefies, and consequently there is apparently no liquefaction. After the gelatin has been liquefied half way down the tube, the mass of germs subsides, and further liquefaction is very slow or does not occur at all.
On agar. Forms a thin white growth, with heavy deposit often in water of condensation.
On potato. Abundant, faintly yellow, mucilaginous growth, without raised edges.
In Parietti's solution. Does not grow.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows well at ordinary temperature; feebly at 38° C.
Rate of growth. Very rapid at ordinary temperature.
Production of gas. None observed.
Liquefaction. Liquefies half-way down the tube.
Color. White.
Toxicogenic properties. Negative.

No. 25. *Micrococcus Aquatilis.*

Form. Small cocci, often in groups.
Growth:
On gelatin plates. Small, round, white colonies.
In gelatin tubes. Very feeble growth along the line, but spreading over the surface.
On agar. White, thin growth.
On potato. Brownish, moist growth.
In Parietti's solution. Grows.
In Uffelmann's gelatin. Does not grow.
Effect of temperature. Grows at ordinary temperature, also at 38° C.
Rate of growth. Slow.
Relation to air. Aërobic.
Production of gas. None observed.
Liquefaction. Negative.
Color. White.
Toxicogenic properties. Negative.

No. 26. *Bacillus Albus Anaërobiescens.*

Form. Bacilli, two to three times as long as broad.
Motility. Only an oscillation.
Growth:
On gelatin plates. Smooth, spherical, yellowish or brownish colonies.
In gelatin tubes. Grows well along the track, and spreads over the surface.
On agar. Heavy, milk-white growth.
On potato. Yellowish-white, glistening growth.
In Parietti's solution. Grows.
In Uffelmann's gelatine. Grows, and stains with the same intensity as Eberth's germ.
Effect of temperature. Grows at ordinary temperature, and also at 38° C.
Rate of growth. Rapid.
Relation to air. Grows under gelatin.
Production of gas. None observed.
Liquefaction. Does not liquefy.
Color. White.
Toxicogenic properties. Negative.

No. 27. *Bacillus Invisibilis.*

Form. Large bacilli, from two to five times as long as broad, with rounded ends.
Motility. Motile.
Growth:
On gelatin plates. Pale yellow burr-like colonies, with irregular outline, and spreading slightly.
In gelatin tubes. Grows abundantly along the track, and spreads slowly over the surface.
On agar. Thick white growth, with but little tendency to spread.
On potato. Invisible growth.
In Parietti's solution. Grows.
In Uffelmann's gelatin. Grows abundantly, but does not take up the stain.
Effect of temperature. Grows at ordinary temperature, and at 38°.
Rate of growth. Rapid.
Relation to air. Grows under gelatin.
Production of gas. None observed.
Liquefaction. Does not liquefy.
Color. White.
Toxicogenic properties. Negative.

No. 28. *Bacillus Venenosus.*

Form. A bacillus from two to four times as long as broad, with rounded ends.
Motility. Very motile.
Growth:
On gelatin plates. Small, white dots, spherical, and sometimes slightly yellow. The superficial colonies are raised above the surface of the gelatin.
In gelatin tubes. Grows abundantly along the line, and slowly spreads over the surface. When taken from the spleen of an animal which has died twelve days or later after inoculation, the tendency to spread over the surface of the gelatin is less marked than with the germ which has not passed through the animal body.
On agar. A thin white growth.

On potato. A light brown, moist growth. When the germ is taken from the spleen of an inoculated animal the growth is often invisible.

In Parietti's solution. Grows abundantly.

In Uffelmann's gelatin. Grows abundantly, and the superficial colonies stain intensely, while the deeper ones are not so markedly stained as those of the Eberth germ.

Effect of temperature. Grows rapidly both at ordinary temperature and at 38° C.

Rate of growth. Rapid.

Relation to air. Grows well under gelatin.

Production of gas. None observed.

Liquefaction. Does not liquefy.

Color. White.

Toxicogenic properties. Toxicogenic in rats, mice, guinea-pigs, and rabbits. See experimental evidence on this point given later.

No. 29. *Bacillus Venenosus Brevis.*

Form. A thick, short bacillus; length about twice the width; grows in threads in old cultures.

Motility. Motile.

Growth:

On gelatin plates. Small, round colonies, with concentric rings. Generally, the deeper colonies are yellowish or brown. The surface colonies are raised, and spread but little. On plates made from the spleen of an inoculated animal the colonies are less regular in outline, and show a marked tendency to spread over the surface.

In gelatin tubes. Grows well along the line and spreads slowly over the surface, but finally extends to the sides of the tube.

On agar. Thin, white growth.

On potato. Moist, light brown, thick growth. Cultures which have been kept for fourteen days or longer at 40° form an invisible growth on potato. The medium used in these experiments was fresh spleen from man.

In Parietti's solution. Grows abundantly.

In Uffelmann's gelatin. Grows slowly, and takes the stain less markedly than does Eberth's germ.

Effect of temperature. Grows both at ordinary temperature and at 38° C.

Rate of growth. Rapid.

Relation to air. Grows well under gelatin.

Production of gas. None observed.

Liquefaction. Does not liquefy.

Color. White.

Toxicogenic properties. Toxicogenic in rats, mice, and guinea-pigs, and rabbits.

No. 30. *Bacillus Venenosus Invisibilis.*

Form. A slender bacillus; length, from two to four times the breadth. Ends are rounded.

Motility. Motile.

Growth:

On gelatin plates. Colonies are small, yellowish, and granular. Surface colonies are very irregular in shape and size, and are coarsely granular.

In gelatin tubes. Grows very slowly both along the line and at the surface; scarcely visible after three days.

On agar. A very thin, white growth.

On potato. On some potatoes the growth is invisible; on others there is a light brown growth.
In Parietti's solution. Grows well.
In Uffelmann's gelatin. Grows well and stains.
Effect of temperature. Grows at ordinary temperature and at 38°.
Rate of growth. Slow.
Production of gas. None observed.
Liquefaction. Does not liquefy.
Color. White.
Toxicogenic properties. Toxicogenic, but in less degree than bacillus venenosus. (See inoculation experiments.)

No. 31. *Bacillus Venenosus Liquefaciens.*

Form. A bacillus, whose length is from one and one-half to two times its breadth, and which has rounded ends.
Motility. Motile.
Growth:
On gelatin plates. The superficial colonies are raised, and spread over the surface. The deep colonies are yellowish and finely granular, with unbroken outline.
In gelatin tubes. Grows along the line abundantly, and spreads over the surface slowly. Liquefaction begins after from four to six weeks.
On agar. A thin, white growth.
On potato. A moist, light brown or yellowish growth. When kept for fourteen days or longer on spleen tissue, it forms an invisible growth on potato.
In Parietti's solution. Grows abundantly.
In Uffelmann's gelatin. Grows abundantly and stains deeply.
Effect of temperature. Grows at ordinary temperature and at 38°.
Rate of growth. Rapid.
Relation to air. Grows under gelatin.
Production of gas. Gas bubbles occasionally appear in gelatin tubes.
Liquefaction. Liquefies gelatin after some weeks.
Color. White.
Toxicogenic properties. Toxicogenic to mice, rats, guinea-pigs, and rabbits. (See inoculation experiments.)

The effects of the toxicogenic germs which I have described are compared with those of the Koch-Eberth germ. None of these can be said to be highly toxicogenic to the lower animals. They are not comparable with the germs of anthrax, glanders, tetanus, or diphtheria. I have made a great many inoculation experiments with these germs, but will detail only a few which I have made recently. In my inoculation experiments with Eberth's bacillus, I have used a germ obtained by myself from the spleen of a person dead from typhoid fever, and a germ obtained from the Berlin Hygienic Laboratory. The two sets of inoculations are detailed separately.

Results of Inoculations.

Bacillus Venenosus.

Experiments 1–5.—Five white rats were inoculated by the injection of two cubic centimetres of an alkaline nuclein[1] culture, twenty-six days old,

[1] The preparation of this medium will be described in a later paper on the chemical products of these germs.

into the abdominal cavity. All died within twenty-four hours. The spleen, kidneys, and liver were found engorged. Plates made from these organs showed abundant growth of the germ in pure culture. Five cubic centimetres of this culture, after being freed from germs by filtration through porcelain, were injected into the abdominal cavities of rats without effect.

Exp. 6–20.—Fifteen white rats were inoculated by the injection of two cubic centimetres of a beef-tea culture, grown for twenty-four hours at a temperature of 38°, into the abdominal cavity. All died within twenty-four hours. The spleen, kidneys, and liver were engorged. Plates made from these organs gave positive results.

Exp. 21–26.—Five white rats were inoculated by the injection into the abdominal cavity of one cubic centimetre of a beef-tea culture, grown for twenty-four hours at 38°. All died within twenty-four hours. Results of the examination and of the plates were the same as those given above. Six cubic centimetres of this culture, after being freed from germs by filtration through porcelain, were injected into the abdominal cavity of rats without effect.

Exp. 27–29.—Three white mice were inoculated by the subcutaneous injection of one cubic centimetre each of nuclein culture six days old. The inoculations were made at 4 P. M. Up to 9 P. M. the animals were apparently unaffected. The next morning they were found with eyes closed, rough coat, refusing to eat, and lying in a stupid state. They remained in this condition throughout the day, and were found dead the next morning, about forty hours after being inoculated. All of these mice suffered from diarrhœa before death. Post-mortem examination showed the intestines containing yellowish, watery feces. No marked changes were observed. Plates were made from the spleen, kidney, and liver of each. All these plates showed pure cultures of the germ.

Exp. 30. A guinea-pig was given two cubic centimetres of a nuclein culture six days old, under the skin of the back. The animal died after forty-eight hours. Examination showed the spleen slightly enlarged, and the intestines filled with watery feces. The animal had marked diarrhœa the day before it died. Plates were made from the spleen, tube cultures from the plates, and potato cultures from the tube. The growths on the potatoes were all less marked than those on companion potatoes made from the tubes of the germ which had not been through an animal.

Exp. 31–33.—Three white rats were given each one cubic centimetre of nuclein culture, six days old, under the skin of the back. The next day all had rough coats and all refused to eat. On the third day after the inoculation one of the rats died. Post-mortem showed the intestines inflamed, and the surface of the liver marked with many white nodules, each of which was about an eighth of an inch in diameter. These spots contained pure cultures of the germ. The spleen, which was engorged, also yielded the germ in large numbers. One of the rats seemed to gradually improve and on the twentieth day it was killed and the kidney, spleen, and liver plated. These plates remained sterile. The third rat developed three large, lymphatic tumors, one in each groin and one in the left axilla. The animal ate its food but still retained its rough coat and became very much emaciated. On the thirtieth day after the inoculation the animal was killed and plates were made from one of these tumors and from the liver, spleen, and kidney. The only abnormality observed in the abdominal organs was the enlargement of the spleen, which was twice as large as normal. A small number of colonies appeared on the plates made from the spleen, while the other plates remained sterile. Tubes were made from the spleen plates and the identity of the germ fully determined. This shows that this bacillus may live in the body of the rat for thirty days. This result I regard as exceptional, and due to the condition of the animal more than to the virulence of the germ.

Exp. 34 and 35.—Injected under the skin of the back of each of two gray mice one cubic centimetre of a twenty-four hours' beef-tea culture. The next day these animals remained in a lethargic condition, and on the following day they died. There was marked congestion of the bloodvessels

of the mesentery and, in one, fecal matter was found in the peritoneal cavity. The spleen, liver, and kidney were dark. Plates made from these organs developed the germ.

Exp. 36 and 37.—Injected under the skin of the back of each of two guinea-pigs two cubic centimetres of a twenty-four hours' beef-tea culture; both had rough coats and ate but little during the next two days. After this one rapidly improved and was soon apparently well. The other gradually lost flesh and died on the twelfth day after inoculation. The only abnormality which could be detected was an enlargement of the spleen, which was at least four times the size of this organ in healthy guinea-pigs. From the spleen, liver, and kidney cultures were made, and on each plate a small number of colonies of the germ appeared. Tube and potato cultures were made from these plates, and a wholly invisible growth formed on the potatoes.

Exp. 38–40.—Inoculated three white rabbits by the injection of three cubic centimetres of an alkaline nuclein culture under the skin of the back. Two of the animals were, so far as could be seen, not affected. The third began, on the second day, to show evidence of a profuse diarrhœa, which continued and was accompanied by great emaciation. The animal continued to eat, and, indeed, it ate more than either of the others, and seemed to have an insatiable appetite. The diarrhœa and emaciation continued for two weeks, and at the expiration of this time it was much reduced, but it continued to eat and soon began to regain flesh. After two weeks more it showed but slight evidence of the previous emaciation.

Exp. 41.—Injected two cubic centimetres of a nuclein culture into the abdominal cavity of a white rabbit about eight weeks old. The next morning the animal had a profuse diarrhœa, and died within forty-eight hours after the inoculation. The spleen was much congested and the small intestines highly inflamed. Plates made from the spleen, liver, and kidney showed abundant germs.

Exp. 42.—Injected two and one-half cubic centimetres of beef-tea culture, seven days old, under the skin on the back of a guinea-pig which had survived a previous inoculation with Eberth's germ. The animal was not affected, so far as could be seen.

BACILLUS VENENOSUS BREVIS.

Exp. 1 and 2.—Injected three cubic centimetres of a beef-tea culture, twenty-four hours old, into the abdominal cavity of each of two large rabbits. Both animals died within thirty hours. The spleen, liver, and mesentery were much congested. Cultures made from the spleen, liver, and kidney showed numerous colonies of the germ.

Exp. 3.—Injected two cubic centimetres of a beef-tea culture into the abdominal cavity of a large rabbit. The animal died within twenty-four hours. The post-mortem appearance and the cultures corresponded with those in the preceding experiments.

Exp. 4.—Injected one and one-half cubic centimetres of a beef-tea culture, twenty-four hours old, into the peritoneal cavity of a large rabbit. The animal rapidly emaciated, and the temperature in the rectum was taken twice a day from the eighth to the seventeenth day after inoculation, and was found to vary from 103° to 104.4°. During this time there was profuse diarrhœa. On the eighteenth day the animal was so weak that it could not stand and it was chloroformed and examined. The following observations made at the examination are given:

1. There was no evidence of suppuration at the point of inoculation or elsewhere.
2. The lower four inches of the small intestines were dark and congested externally, and the lower two inches were entirely denuded of epithelium.
3. The intestines contained a yellowish, frothy fluid.
4. The spleen, liver, and kidney were enlarged and somewhat hardened.
5. Cultures from these organs gave pure cultures of the germ.

Exp. 5.—Fifteen drops of a beef-tea culture were injected into the abdominal cavity of a rat; the animal was found dead the next morning. The spleen, liver, and kidney were congested and cultures from these organs gave positive results.

Exp. 6–10.—Two cubic centimetres of a beef-tea culture were injected under the skin on the back of each of five guinea-pigs. All died within from two to ten days after the inoculation. In all the spleen was found enlarged and cultures from this organ gave positive results

Exp. 11 and 12.—One cubic centimetre of a beef-tea culture was injected under the skin on the back of each of two white mice; the animals died within forty-eight hours and cultures from spleen, liver, and kidney showed abundant colonies of the germ.

BACILLUS VENENOSUS INVISIBILIS.

Exp. 1–10.—Injected one cubic centimetre of a beef-tea culture into the abdominal cavity of each of ten white rats. All died within forty-hours. The spleen, liver, and kidney were congested and cultures from these organs gave positive results.

Exp. 11–14.—Injected one cubic centimetre of a beef-tea culture, twenty-four hours old, under the skin of the back of each of four white mice. All died on the second day. Cultures from the spleen, liver, and kidney gave positive results.

Exp. 15 and 16.—Injected one and one-half cubic centimetres of a nuclein culture under the skin on the back of each of two guinea-pigs; the animals were not affected.

Exp. 17.—Injected one cubic centimetre of a beef-tea culture under the skin on the back of gray mouse. The animal died within twelve hours and cultures were made from the spleen, liver, and kidney with positive results.

BACILLUS VENENOSUS LIQUEFACIENS.

Exp. 1–3.—Injected one cubic centimetre of a beef-tea culture, twenty-four hours old, under the skin on the back of each of three gray mice. One died within eighteen hours, a second within thirty hours, and the fourth within forty-eight hours. Post-mortem examination in each showed marked engorgement of the mesentery and the spleen. Plates revealed the presence of the germ.

Exp. 4–12.—Injected fifteen drops of a beef-tea culture into the abdominal cavity of each of ten white rats. All died within twenty-four hours. Examinations showed the spleen markedly engorged and the liver and kidney slightly so. Plates from these organs gave positive results. Five cubic centimetres of this culture, after filtration through porcelain, were injected into the abdominal cavity of each of five rats without causing death.

Exp. 13.—Injected three cubic centimetres of a beef-tea culture, seventy-two hours old, into the abdominal cavity of a rabbit. The animal died within twenty-four hours. The spleen was found engorged and cultures showed the presence of the germ.

EBERTH'S GERM (*from spleen*).

Exp. 1.—Injected three cubic centimetres of a beef-tea culture, twenty-four hours old, into the abdominal cavity of a rabbit. The animal died within twenty-four hours.

Exp. 2.—Same as No. 1, except that the animal remained apparently unaffected until the eleventh day, when it was found to be completely paralyzed in the posterior extremities. Two days later the rabbit died. Examination showed the mesenteric glands very much enlarged. The mucous membrane of the small intestine was congested; Peyer's patches enlarged; externally the lower end of the small intestine was covered with a

plastic exudate. Cultures were made from kidney, liver, spleen, and blood, but all the plates remained sterile.

Exp. 3–5.—Injected one cubic centimetre of a beef-tea culture, twenty-four hours old, into the abdominal cavity of each of three white rats. One died after forty hours. The mucous membrane of the lower portion of the small intestine was markedly inflamed. Cultures gave positive results. The other rats were not seriously affected.

Exp. 6–8.—Injected into the abdominal cavity of three white rats, respectively, fifteen, ten, and five drops of a beef-tea culture, twenty-four hours old. The one which had ten drops died within twenty-four hours. The post-mortem appearances were like those of the rat which had one cubic centimetre. The other rats were not affected.

Exp. 9–11.—Injected two cubic centimetres of a beef-tea culture into the abdominal cavity of each of three white rats. Two died within twenty-four hours, in each the lower portion of the small intestine was inflamed internally and covered with a plastic exudate externally. Plates made from the liver, spleen, and kidney, gave positive results. The third rat recovered.

Exp. 12.—Injected one-half cubic centimetre into the abdominal cavity of a white rat. The animal did not appear to be seriously affected. It was killed on the fourth day. The spleen was about three times the normal size. Cultures gave numerous colonies.

Exp. 13.—Injected one cubic centimetre of a beef-tea culture, twenty-four hours old, into the abdominal cavity of a half-grown rabbit. The animal died within twenty-six hours. The mucous membrane of the lower portion of the small intestine was slightly inflamed. No other changes were observed. Plates showed numerous colonies.

Exp. 14.—Injected into the abdominal cavity of a guinea-pig one cubic centimetre of a beef-tea culture, twenty-four hours old. The animal died within twenty-four hours. There was slight redness of the small intestine. Cultures gave positive results.

EBERTH'S BACILLUS (*from Berlin*).

Exp. 1 and 2.—Injected one cubic centimetre of a beef-tea culture, twenty-four hours old, into the abdominal cavity of each of two white rats. One died within twenty-four hours. The lower portion of the small intestine was inflamed, and was covered externally with a plastic exudate. The second rat did not die, but was killed on the fourth day. The spleen was enlarged, but not so markedly as in the rat which had been inoculated with the bacillus from the spleen.

Exp. 3 and 4.—Injected two cubic centimetres of a beef-tea culture, twenty-four hours old, into the abdominal cavity of each of two white rats. One died within twelve hours. The spleen, liver, and kidney were engorged. Plates were successful. The second rat did not appear to be affected by the inoculation.

Relation of these Toxicogenic Germs to the Bacillus of Eberth.

From the studies which I have detailed, the following points seem to me to be demonstrated:

1. In their effects upon the lower animals these toxicogenic germs are fully equal in virulence to the Eberth bacillus.

2. The post-mortem appearances in animals dying after inoculation with these germs, are practically identical with those observed in animals killed by inoculation with the Eberth germ.

3. While the bacillus venenosus, as taken from water, forms on potato

a growth wholly different from that of the Eberth bacillus, the former, when taken from animals which have survived the inoculation for twelve days or longer, forms on the potato the invisible growth which is generally supposed by bacteriologists to be characteristic of the Eberth bacillus.

4. Two of these toxicogenic germs form on potatoes invisible growths, when taken from cultures in human spleen which have been kept at a fever temperature for some days.

5. The fourth toxicogenic germ, when taken directly from the water, forms an invisible growth on potato.

If we add to these the fact, well known to bacteriologists, that there are marked morphological and culture differences between Eberth germs from spleens in different epidemics of typhoid fever, and that the most skilful bacteriologists have reported most diversely upon the reaction of the Eberth germ with staining reagents, the evidence becomes sufficient to convince me that the Eberth germ, as found in the spleens and other organs after death, is not a specific microörganism, but is a modified or involution form of any one of a number of related germs. (I have refrained from discussing the reaction of the Eberth germ with staining reagents in this paper because I have elsewhere gone quite thoroughly into this point of controversy.)

If we cannot agree in this conclusion, we must accept the view of Babes, that there are varieties of the Eberth bacillus. It probably makes but little difference whether we conclude that these germs are varieties of one species or that they are related species. I know of no hard and fast lines upon which one can decide, to the satisfaction of everyone else, whether two or more germs, differing more or less, should be classified as species or as varieties.

Of one thing I am certain, and that is that I am ignorant of any crucial test, or of any combination of tests, upon the strength of which I can say at present that a germ which I may find in drinking-water is identical with the so-called typhoid bacillus. I have found in spleens after death from typhoid fever, germs which differ from the typhoid bacillus obtained from Berlin, and from one another as markedly as my bacillus venenosus differs from either or both.

REVIEWS.

REPORT ON CHOLERA IN EUROPE AND INDIA. By EDWARD O. SHAKESPEARE, A.M., M.D., Ph.D., United States Commissioner. Washington: Government Printing Office, 1890.

IN the selection of a Government representative, political expediency is usually the guiding consideration, and the same is unfortunately true in the smaller sphere of medical politics. Nevertheless, the right man now and then obtains the right place, either because his abilities are so conspicuous as to make detraction ridiculous and opposition futile, or from the force of circumstances apparently fortuitous.

There was nothing fortuitous in Dr. Shakespeare's appointment "as a representative of the Government of the United States, to proceed under the direction of the Secretary of State, to Spain and such other countries of Europe where the cholera exists, and make investigation of the causes, progress, and proper prevention and cure of the said disease." . . . Before bacteriology was regarded as a science, his reputation as a pathologist was thoroughly established, and he was among the first to recognize the fundamental relations of microörganisms to disease, and to familiarize himself with the technique of their study. He carried with him on his mission the confidence of the entire profession, and that it was not misplaced is proved by the Report now before us.

The book is a storehouse of information on all relating to cholera, and will always be consulted as a standard authority by the hygienist, the statistician, the bacteriologist, and the medical practitioner.

The author's method of arranging and classifying the details of his vast subject is an admirable one. He begins by studying the course of the cholera epidemic immediately preceding the one which he personally investigated, describes its introduction into Egypt, and its prevalence throughout that country in 1883, and treats in detail of the sanitary conditions there prevailing. He next traces the disease to France, Italy, Spain, and other European countries, and finally, to the port of New York, which it reached on September 23, 1887. In the numerous sections of this chapter of 370 pages, elaborate details are given of the sanitary conditions of the towns in which the epidemic was rife.

Chapter II. deals with the topography and demography of British East India in relation to cholera, and is, from the vitally important standpoint of prophylaxis, the most important part of the Report. It contains a most emphatic denunciation of the criminal negligence which permits the periodic migration of cholera, in company with the Mohammedan pilgrims to Mecca, from the port of Bombay.

India is universally acknowledged to be the home of cholera, and after reading Dr. Shakespeare's description of the filthy habits of the Hindoos, it is easily understood why this is the case. Until this immense focus of

infection is sterilized it is a constant menace to the world, the various governments of which have the right to demand what measures to accomplish this end are being carried out by the Government of India. According to Dr. Shakespeare, they are absolutely futile; they can, he says, "never accomplish it, so long as the present customs of caste and modes of life of the inhabitants prevail." In fact, according to this Report, the Government of India is inclined to repress too zealous efforts at sanitary reform, as is evidenced by the fact that Dr. Simpson, the health officer of Calcutta, was publicly reprimanded for pointing out the "filthy sanitary condition of the native population of Calcutta, and the urgent necessity for prompt and radical reforms."

Chapter III., which is entitled "Bacteriological Investigations and Literature," is a compilation of the principal literature concerning the comma bacillus, and contains papers by Koch, Klein and Gibbes, Cheyne, Nicoti and Rietsch, Klebs and Ceci, Ferrán, and many others. The Stillé of the next generation, if it produces one, will find here, ready to his hand, all the materials for continuing the history of cholera.

Chapter IV. treats of the etiology of cholera and its differential diagnosis from malaria, and contains the author's personal observations concerning the etiology of Asiatic cholera. The result of the latter has forced him to admit that the "claim made by Koch must be regarded as established, namely, that the presence of his comma bacillus in the alvine evacuations, or the intestinal contents, or vomit of an individual suffering with a suspicious attack, furnishes a ready, safe, and absolutely reliable means of diagnosis of Asiatic cholera."

The importance of the discovery of an organism peculiar to cholera is incalculable, for, as pointed out in connection with the introduction of cholera into France and Spain, valuable time has been wasted in the beginning of all epidemics in discussing the nature of the disease

This chapter contains a digression from the subject of cholera which, on superficial examination, seems unwarranted. I refer to the section on malaria, with its beautiful illustrations of the hæmatozoön malariæ in its various transformations. When, however, it is ascertained by more careful reading that the sanitary commissioner of the port of Bombay —the port from which cholera accompanies the Mohammedan pilgrims to Mecca—has pronounced cholera to be only a pernicious form of malaria, and neither transportable nor contagious, it becomes evident that he and others in India holding such views should be instructed in the means of distinguishing between cholera and the malarial fevers.

The question of immunity is discussed in Chapter V., and forms an appropriate introduction to preventive inoculation, which is the subject of Chapter VI. Griesinger, Colin, Proust, Koch, and others, are quoted in favor of the view that one attack of Asiatic cholera confers at least a short immunity from subsequent attacks. While in Spain, Dr. Shakespeare prepared a circular letter containing twenty-five questions concerning the etiology, nature, and prophylaxis of cholera, one of which requested the physician to state whether he was acquainted with instances of second or third attacks of cholera during the same epidemic. This circular was sent to about twenty-five hundred physicians residing in the cities, towns, and villages which had suffered from the epidemic. Among the "large number" of replies (the number is not mentioned) there were only eight in which a second attack was reported, and "from an examination of the details of these there was no doubt left in our mind that six

were not second genuine attacks after a complete recovery, but were in reality relapses due to imprudences of diet or otherwise, before convalescence and complete recovery had been established."

The fact of immunity being conferred by an attack of cholera is, however, better supported by a number of charts which show the periodic recurrence of cholera epidemics. This periodicity is especially marked outside of the regions where cholera is endemic, viz., in Bengal and Assam. The periodical recurrences of cholera in India bear a striking resemblance to those of smallpox, of which graphic charts are also given, "the immunity seeming to be more or less positive for from two to five years."

Chapter V. is partly devoted to a defence of Dr. Jaime Ferrán, of Tortosa, and an investigation of his method of preventive inoculation. Dr. Shakespeare, like many others, had been prejudiced against Dr. Ferrán by publications in the medical and secular press, and had besides been told by those whose opinions in other matters he valued, that the Ferrán question was unworthy of serious consideration. It was this very abuse of the man which decided Dr. Shakespeare to visit him in his own home and investigate his methods, and there is no incident in the course of his extensive travels which so thoroughly exhibits the manly spirit in which the work of our Commissioner was performed. The account of the interview with Ferrán is most interesting; suffice it to say that Dr. Shakespeare left Tortosa "with a very different opinion concerning the character and accomplishments of Dr. Ferrán" than he had entertained before making his visit to that city.

The claims of Ferrán are thoroughly investigated and, it is needless to say, with characteristic impartiality. The result is "the belief that subcutaneous inoculations into man of pure liquid cultures of the comma bacillus of Koch, whilst they do not usually excite disturbances which in any way resemble Asiatic cholera, apparently exercise a certain protective influence through the establishment of a considerable degree of immunity from attack and death by cholera."

Chapter VII. deals with measures of prevention, general and individual, and contains an elaborate argument in favor of national control of maritime quarantine.

The last chapter of this colossal work deals with the etiology, pathology, symptomatology, prognosis, and treatment of cholera, and has for the most part already appeared in Keating's *Cyclopædia of the Diseases of Children*. It contains in a few pages those facts concerning the disease which are of the greatest interest to the practitioner.

The above remarks may serve to convey an idea of the nature of this Report, the value of which depends, not so much upon its stupendous array of facts as upon their judicious selection and arrangement, and the critical remarks by which they are accompanied.

The unflagging zeal displayed by Dr. Shakespeare in the prosecution of this research is worthy of the highest commendation. No considerations of personal convenience or safety seem to have entered his mind. For example, he spent the summer months in India, and during one of them was prostrated by illness, and, as is well known to the physicians of Philadelphia, he returned to that city with health so shattered that it was many months before he could begin the arduous work of his Report. The delay in its publication was keenly felt, but solely because all were anxious to see what all knew would be a masterpiece.

F. P. H.

CLINIQUE DES MALADIES DU SYSTÈME NERVEUX—M. LE PROFESSEUR CHARCOT. Leçons du Professeur, Mémoires, Notes et Observations, pendant les années 1889-90 et 1890-91, et publiés sous la direction de Georges Guinon, Chef de Clinique. Tome I. Paris, 1892.

CLINICAL LECTURES ON DISEASES OF THE NERVOUS SYSTEM. By PROFESSOR CHARCOT, etc. Paris, 1892.

THE appearance of a new book from Charcot's clinic is a conspicuous event. From no other source does the medical world expect so much and such perfect and attractive clinical work in the field that the author has made his own; and it is rarely disappointed. This volume is a collection of Charcot's more important lectures, delivered during the last two years, and of notes and observations by his assistants and students at the Salpêtrière. It is a notable book. It contains much that is new; and some that is even not entirely new gains a freshness and vigor, and acquires an individuality and importance, that Charcot knows well how to impart. In his preface he says that such a collection may be useful to those who are interested in the facts of neuro-pathology. But it is more than useful—it is indispensable. It will be received with satisfaction as a continuation of the author's great treatise on *Diseases of the Nervous System;* and the periodical appearance in the future of similar volumes, pioneers doubtless in a progressive neurology, will be of the first importance.

The book contains too much to be noticed here in detail. We shall select only the more important subjects.

Morvan's disease is discussed at length. First described in 1883 by Morvan, of Lannilis, who called it "analgesic paralysis of the upper limbs, with whitlow," its autonomy is still disputed by some. Charcot distinguishes it from scleroderma of the finger, from anæsthetic leprosy, and from Reynaud's disease. It has three predominant symptoms: (1) Pain. (2) Paralysis with analgesia of one side, then of the other. (3) Whitlows. The paralysis and anæsthesia sometimes precede the pain. Other trophic disorders may appear. The "dissociation symptom" of syringomyelia, *i. e.*, the preservation of tactile sensation with abolition of the pain and temperature senses, is not observed—at least Morvan claimed that it was not observed, and this is considered by some to distinguish the disease from gliomatosis of the cord, or syringomyelia. The whitlow begins like a common felon, with redness, heat, and swelling, but it is always a grave complication, destroying the distal phalanges and sometimes even those next. Occasionally a scoliosis of the spine is observed. The duration of the disease is long, its prognosis is grave, and its etiology is almost unknown. Morvan believed that its seat is in the cord at the origin of the brachial nerves. The first autopsy showed no cavities in the cord, but only a sclerosis. In a later lecture, however, Charcot reviews the subject again, and concludes that Morvan's disease is only a special type of syringomyelia.[1]

Hysterical tremors are described in an elaborate essay. They are classified, as is the French mode, and presented in groups. This makes

[1] *Vide* Leçon No. XII., "Sur un cas de Syringomyélie avec Panaris analgésiques—type Morvan" (p. 243).

the study of them easy and attractive, but does not avoid the suspicion that perhaps they are not so nicely differentiated in nature. It is remarkable, as Charcot says, that this part of the symptomatology of hysteria has been so much neglected. Even the work of Briquet, so complete in other respects, has but an allusion to tremor. To Rendu and a few other recent French writers all the credit is given of "opening a new era" by describing the various types of this symptom. As is too common among his countrymen, Charcot does scant justice here to American writers. Mitchell, years ago, although he abstained from classification, discussed the tremor of hysteria in his well-known monograph. Charcot contends that hysteria simulates all the tremors of organic origin, and, accordingly, divides the hysterical tremors into groups simulating the tremor repectively of paralysis agitans, exophthalmic goitre, alcoholic and general paralysis, disseminated sclerosis, and mercurial poisoning. The association of the tremor, of whatever type, with hysterical stigmata; the relation of trauma to hysterical tremor; the posssible identity of this tremor and that of mercurial poisoning, are among the important subjects discussed and elucidated.

Migraine appears to be one of the most varied of nervous diseases. Charcot adds to our knowledge of it, the description of a type of rare interest. He calls it *migraine ophthalmoplégique*. This form of migraine is accompanied by a paralysis of the oculo-motor nerve, involving the branches to both the exterior and interior muscles of the eye. Therefore the syndrome is an almost complete ophthalmoplegia, externa and interna, involving the iris and ciliary muscle as well as the muscles of the eyeball supplied by the third nerve. The fourth and sixth nerves apparently escape. This ophthalmoplegia follows a paroxysm of pain and vomiting, identical with that of the classical migraine. The eye may be congested; ophthalmoscopic examination gives negative results. The author makes valuable historical notes and references.

Charcot reports, and studies carefully, two cases of muscular atrophy associated with ophthalmoplegia externa. This combination is exceedingly rare, and depends upon degeneration of the nuclei, in the mid-brain, of the motor nerves to the orbit, identical and synchronous with the degeneration of the motor nuclei in the anterior horns in the cord. This syndrome, ophthalmoplegia externa, or nuclear ophthalmoplegia, interests the general clinician more directly even than the ophthalmologists, who almost exclusively have studied it. Hutchinson first described it fully and gave it the present name, which ought to be slightly changed, as Mauthner suggests, so as to be read "exterior" rather than "externa." It means, of course, a paralysis *not* of the externus muscle only, but of all the exterior muscles of the eye, as well as of the elevator of the upper lid, as distinguished from the interior muscles—the iris and the ciliary muscle—which escape. Several disease-processes may cause this complexus of symptoms. Tumor of the mid-brain is one, although in our observation this is likely to involve the nerves to the iris and the ciliary muscle. Certain acute inflammatory or destructive processes, as alcoholism and diphtheria, may cause complete or partial ophthalmoplegia, as Wernicke and others have shown. It may appear with locomotor ataxia and general paresis. Finally, as Charcot shows in his present lecture, ophthalmoplegia externa may be combined with a more or less general muscular atrophy, either subacute, or slow and progressive. He suggests that this impairment of the mid-brain be

called superior bulbar paralysis, in contradistinction to the commonly observed, or *inferior*, bulbar paralysis. From both the historical and clinical standpoints this lecture is very full and instructive.

In another lecture Charcot discusses the relation of diabetes to diseases of the nervous system, and describes especially diabetic paraplegia. This is apparently a peripheral neuritis, very similar to the pseudo-tabes caused by alcohol and lead. It is marked by fulgurant pains, dysæsthesiæ, abolition of the knee-jerks, swaying, and an altered gait. The author protests that this gait, in both diabetic and alcoholic paraplegia, should not be called *ataxic*. It is a true *démarche de stepper*, not an ataxia, and is caused by paralysis of the extensor muscles and consequent falling of the foot. Hence the patient has a high-stepping gait. Charcot, as usual, makes interesting historical observations, and calls attention to the fact that whereas originally, owing to the brilliant experiments of Bernard, diabetes was believed to be caused always by a lesion of the floor of the fourth ventricle, hence to be primarily a nerve-lesion, it is in comparatively recent days that the importance of nerve-lesions secondary to diabetes has been recognized.

We have reviewed this valuable book at sufficient length. Many other subjects, equally attractive and suggestive, are presented in a series of lectures each of which is a monograph. These products of this noted contemporary clinic, presented with the literary skill of a master, need no commendation nor even this brief introduction to studious readers, who will appreciate them well. J. H. L.

DISEASES OF THE EYE. A HANDBOOK OF OPHTHALMIC PRACTICE FOR STUDENTS AND PRACTITIONERS. By G. E. DE SCHWEINITZ, M.D., Professor of Diseases of the Eye and Ear in the Philadelphia Polyclinic; Lecturer on Medical Ophthalmoscopy in the University of Pennsylvania, etc. With two hundred and sixteen illustrations and two chromo-lithographic plates. Pp. 641. Philadelphia: W. B. Saunders. 1892.

WHEN this book came to our attention we said, Surely the assertion of the wise man of old, Solomon, is right—"Of making many books there is no end." In the past five years we have had as many volumes on this well-worn subject, with but little new matter. It is too much the practice for teachers in medical schools to write books for no other reason than that the students of their school or college will read them.

We have here not only the experience of Dr. de Schweinitz, in the parts relating to the diseases of the eye, but the experience and style of Dr. James Wallace, of the University Hospital, in those relating to the optical principles, refraction, and the like; and the aid of Dr. Edward Jackson on the subject of retinoscopy—for what reason does not appear.

The volume contains twenty-two chapters, a bibliography, and an index.

Chapter I., by James Wallace, M.D., treats of "General Optical Principles," and contains fifty-six pages, with the usual illustrations. The question of the *centrad* and *prism-dioptre*, as applied to prisms, is gone into, and a table gives their relative values. We quite agree with the writer that this new method of designating prisms is of value, especially in determining the prismatic deviation of a decentred lens: if a lens

be decentred one centimetre, the prismatic deviation of the lens will be equal to as many prism-dioptres as the number of dioptres in the lens.

Chapter II. is on "External Examinations of the Eye." The treatment of "balance of the external eye muscles" is most clearly and concisely written, and no one can fail to find profit in reading it.

Chapter III., "Reflection, the Ophthalmoscope, and the Theory of Ophthalmoscopy and Retinoscopy," consists of forty-six pages, with the usual illustrations. And, strange to say, the author does not present any particular form of ophthalmoscope which he prefers, and to which he has added some peculiar wheel or cog, as is usually the case in recent books on this subject. We congratulate the writer on his being satisfied with the instruments now at our disposal.

"Ophthalmometry" is mentioned in a few words; we should judge that our Philadelphia brothers are not as enthusiastic over its usefulness as are those of a neighboring city. Retinoscopy is treated of by Dr. Jackson in a very clear and plain manner. We agree with him as to its usefulness and ease of application.

Chapter IV., "Normal and Abnormal Refraction," by James Wallace, M.D., takes fifty pages, but we find nothing new nor any plainer exposition of facts for the student. Dr. Jackson's tables showing the amount of deviation which is produced by decentring a spherical lens are useful, and close the chapter.

In the section on "Diseases of the Conjunctiva," we are sorry to see the terms "chronic," "military," and "toxic ophthalmia," when the word *conjunctivitis* should be used.

Chapter XII., on "Glaucoma," is concise and perfect, giving all methods of treatment to date. We think, however, that many cases of acute glaucoma may be cut short and permanently relieved by sulphate of eserine; the author speaks of it rather as a temporary agent.

The chapters on the diseases of the interior of the globe are all excellent and the teaching sound. Space forbids more extended mention.

Chapter XIX., "Movements of the Eyeballs and Other Anomalies," is one of the best in the volume, and, in point of original matter and illustration, to our mind takes the lead of the previous chapters in practical and lucid demonstration.

We agree with the author that the adoption of the nomenclature of Dr. Stevens is a more convenient manner of describing weakness of muscular action than the old method; this is perfectly consistent, and at the same time does not commit the author to any of Dr. Stevens's theories as to etiology of nervous affections, etc.

Chapter XXII. describes the operations upon the eye and its appendages, in about fifty pages, with numerous illustrations.

The directions as to the preparation of the hands of the operator, the patient, and the instruments will suit the most fastidious believer in antiseptic surgery.

All that is said about the extraction of cataract is good and sound, only we wish the author would express his own views of preference rather than those of another. Partial and graduated tenotomy is mentioned without comment of condemnation or praise. We should have been pleased to have seen it omitted, as we consider the method as described in the text, and as we have seen it performed, unscientific.

Taken as a whole, the volume just closed is a good, sound, and concise record of the facts known to ophthalmic science, given in a plain

manner and without comment: this, to our mind, is the principal fault. Many of the plates are fair, but we must confess to a feeling of disappointment, as in these days of photography certainly better results should be obtained.

The publishers have done their work well, and in conclusion we can wish the volume a large sale and field of usefulness. W. O. M.

THE TREATMENT OF TYPHOID FEVER; AND REPORTS OF FIFTY-FIVE CONSECUTIVE CASES WITH ONLY ONE DEATH. By JAMES BARR, M.D., Physician to the Northern Hospital, Liverpool, etc. With an introduction by W. T. GAIRDNER, Professor of Medicine in the University of Glasgow, etc. 8vo., pp. 212. London: H. K. Lewis. 1892.

THIS book derives interest from a well-written historical sketch of the treatment of the continued fevers from the time of Sydenham, and an account of the author's method of treating typhoid fever. The historical sketch runs in somewhat narrow lines, and chiefly refers to the work done by British physicians. The author's method of treating his severe cases of enteric fever, as carried out in the Northern Hospital of Liverpool, certainly marks a new departure in the management of this disease. It consists in the use of the tank as a means for continuous immersion, as introduced in 1861 by Hebra for the treatment of burns, scalds, psoriasis, and other extensive lesions of the skin.

The author's tank consists of a wooden box, six feet long, two feet ten inches wide, and sixteen inches deep. It is lined with lead, painted, and covered with a thick coat of shellac. It is provided with a large discharge-pipe communicating with a soil-pipe leading down to the sewer. It is capable of holding seventy gallons of water and of being emptied in three minutes. There is hot- and cold-water connection. The patient's body rests upon a sheet of bed-ticking, stretched at a level which enables the patient to be submerged, with a strip about a foot wide for the head, which rests upon an air-pillow, "so as to keep the head above water, which is a most essential matter in most conditions of human life." The patient, wrapped in a blanket, is thus submerged. The tank is covered with a half-lid. The author suggests that the tank might easily be provided with a small circulating boiler to maintain a uniform temperature, but that this is unnecessary, as by the removal of a quantity of water and the addition of hot water at intervals a sufficiently equable temperature may be maintained. A thermometer is kept constantly in the tank. The water is kept at a temperature varying from 90° to 98° F. Further points of treatment are given in sufficient detail. Full notes of twenty-two cases treated by this method are appended. Of these cases one only terminated fatally. The histories of a number of other cases treated by the expectant-symptomatic plan, and general observations on diagnosis and prognosis, make up the body of the book.

The author regards his plan of treating enteric fever by continuous immersion as simply a modification of and an improvement upon the method of treating this disease by systematic cold baths originated by Brand.

In this opinion we cannot concur. The action of the continuous bath is essentially different from that of the cold bath given regularly at intervals of three hours so long as the temperature continues to rise above 102° F.

The stimulus to the respiratory centres, to the circulation, to the skin, produced by the sudden immersion in cold water; the abstraction of heat resulting from the continuous agitation of the water in contact with the surface produced by briskly rubbing the patient's skin during the bath; the favorable influence upon the peripheral circulation brought about by warm blankets and alcohol after the bath, and the rhythmical repetition of these influences, constitute a therapeutic procedure totally differing in every respect from that of continuous immersion. It is to these rhythmical alternations of influences upon the nervous system as well as to its distinct antipyretic working that the beneficial effects of the method of systematic cold bathing are attributed by Brand and his followers.

Dr. Barr's method, ingenious and bold as it is, has been followed by good results in this first series of cases. Should these favorable results continue in larger series in the future he will doubtless be followed elsewhere, with the result of finally determining the value of the plan.

J. C. W.

THE PATHOLOGY AND TREATMENT OF GLAUCOMA. By PRIESTLEY SMITH, Ophthalmic Surgeon and Clinical Lecturer on Diseases of the Eye, Queen's Hospital, Birmingham, etc. London: J. & A. Churchill. 1891.

THIS work of 200 pages is a revised and enlarged edition of the Erasmus Wilson Lectures delivered before the College of Surgeons of England, in March, 1889, which, when first published, established the reputation of the author as an authority on glaucoma. It is a record of numerous painstaking and careful physiological experiments, with their results, as well as a statement of deductions drawn from the examination and analysis of many pathological specimens.

Lecture I. discusses physiology exclusively, and the methods of estimating tension of the eyeball by palpation and by instruments invented for the purpose. Experiments of Mr. Smith and those of other well-known physiologists determine the following important facts: "That the fluids which nourish the vitreous body and the lens and fill the aqueous chamber are secreted chiefly by the ciliary portion of the uveal tract; that the larger portion of the secretion passes directly into the aqueous chamber, forward through the pupil, and out at the filtration angle; a very much smaller portion passes backward through the vitreous body and escapes at the papilla; and that the hyaloid membrane is readily permeable by the vitreous fluid."

Lecture II. considers the causes and conditions of increased intra-ocular tension—among them are hypersecretion, serosity of fluids, and obstruction of the filtration angle. As proof of the last, the author cites as accepted causes of secondary glaucoma, annular posterior synechiæ, perforating wounds and ulcers of the cornea, with anterior synechiæ, dislocation and swelling of the lens through injuries, operations, and intra-ocular tumors: in all these the angle becomes closed.

Lecture III. considers in detail the predisposing causes of idiopathic or primary glaucoma: 1. The disposition of the lens to increase in size from ten years to seventy, disproportionately to the increase in growth of the ball. Thus "between twenty-five and sixty-five years of age it adds one-third to its weight, one-third to its volume, and one-tenth to its diameters." 2. The liability to glaucoma increases proportionately with the age. This is demonstrated by a series of tables in the appendix. 3. The liability is greatest in small eyes. The author demonstrates this proposition by measurements taken from a moderately large number of healthy and glaucomatous eyes and classified into tables, as well as by photographs of normal and abnormal specimens which had been subjected to similar methods of preparation, and claims that in each of the glaucomatous eyes were found a small globe, a disproportionately large lens, a shallow anterior chamber, a closed filtration angle, an atrophied ciliary body, and an excavated optic nerve.

Among the exciting causes of this form of glaucoma he mentions congestion and inflammation of the uveal tract as caused by exposure, constipation, hunger, sleeplessness, bodily and mental fatigue, mydriatics, etc.

An enumeration of the most common symptoms follows, with a short explanation of the manner of their production. In discussing the treatment, eserine and cocaine in combination are mentioned as an effective means in the "initial" stage "to ward off an attack"—the former to contract the pupil, the latter to contract the vessels of the ciliary body and iris. Sclerotomy he admits to be useful at times, but inferior to the proper operative treatment—iridectomy. His theory of the effectiveness of iridectomy is that the closure of the filtration angle is substituted for the permanent filtration in the neighborhood of the cicatrix, aided immediately after the incision by the escape of the aqueous, relief to circulation by the removal of pressure and simultaneous advance of the lens, escape of blood and draining of fluid from the anterior chamber.

In the appendix are tables of classification of 1000 cases, in relation to age, sex, and measurements of crystalline lenses. The last pages describe the methods of preparing and examining specimens.

It must be remembered by the reader of this work that it is not a monograph or a text-book on the subject of glaucoma, and that it does not pretend to deal exhaustively with the subject. Its theme is limited to a consideration of the pathology and treatment. Notwithstanding that the reviewer has borne this fact constantly in mind, he must confess to a feeling of disappointment. The original investigations, which are described at too great length, seem to have been undertaken with the definite object of proving certain theories which had already found a firm footing in the investigator's mind, and the author has accorded too little space to experiments and results which do not tend to confirm his opinions. He has succeeded in demonstrating, for instance, that closure of the filtration angle, upon which he lays the greatest stress, occurs nearly constantly in glaucoma; but other investigators are not convinced that it is the cause, considering it rather the effect, of the glaucomatous process On the other hand, while there is nothing new or startling, the material is well arranged and the ideas are clothed with fitting phraseology, and are of sufficient importance to warrant the attention of students of ophthalmic science.

The publisher should be credited with the excellence of the mechanical details and the absence of all typographical errors. H. F. H.

PROGRESS

OF

MEDICAL SCIENCE.

THERAPEUTICS.

UNDER THE CHARGE OF

REYNOLD W. WILCOX, M.A., M.D., LL.D.,

PROFESSOR OF CLINICAL MEDICINE AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL; ASSISTANT VISITING PHYSICIAN TO BELLEVUE HOSPITAL.

NOTE ON CODEINE SULPHATE.

MR. JOSEPH W. ENGLAND makes mention of the fact that this remedy is an extremely prompt sedative in affections of the respiratory tract, possessing an advantage over morphine in that it does not check the secretions, nor does it lead to a habit, nor has it disagreeable after-effects. It will indeed alleviate pain. The dose varies from one-eighth to one-half, and exceptionally, one grain, given in pill or in solution, frequently in syrup of wild cherry. The officinal alkaloid is rarely used, the sulphate being more frequently prescribed. If administered in water an insoluble residue is sometimes found, which, on examination, was proved to be the alkaloid codeine found in codeine sulphate from the excessive heat employed in concentration of the solution for crystallization.—*American Journal of Pharmacy*, 1892, No. 3, p. 120.

THE TREATMENT OF BASEDOW'S DISEASE.

DR. F. DÉLÉAGE, for the paroxysms of oppression and palpitation applies ice to the precordial region, and administers digitalis, two and a half grains of the dried leaves, every half-hour for two or three hours. If relief is not obtained before the expiration of three hours, a phlebotomy is indicated. Mentioning the treatment as proposed by Cheadle—tincture of iodine internally, the three bromides, digitalis, belladonna; by Sée—veratrum viride, hydrotherapy, electricity; by Dieulafoy—ipecac, digitalis, and opium, he states that the last method seems to yield very satisfactory results. One-half grain of powdered ipecac, one-third of a grain of powdered leaves of digitalis, and one-sixth of a grain of extract of opium for each pill, of which the daily dosage is four to six. The improvement is usually rapid, the only inconvenience being a diarrhœa.—*Revue de Thérapeutique Générale et Thermale*, 1892, No. 7, p. 97.

Phenocoll Hydrochloride.

Dr. Paul Cohnheim reports a very carefully conducted series of observations. As an antipyretic, a considerable effect was obtained from four grains; the largest single dose was fifteen, the largest daily dose, seventy grains. In hectic, a seven-grain dose reduced the fever from two to four degrees; hence he concludes that it is equal to the more important antipyretics. In his cases it appeared to have no unfavorable action, nor to give rise to exanthemata. As an analgesic it failed in hysteria, in which other anti-neuralgic remedies and narcotics had failed. As an anti-rheumatic it was successful in acute, but failed in chronic articular rheumatism. In asthma there was no result.—*Therapeutische Monatshefte*, 1892, i., S. 15.

Solanine.

Dr. Ch. Eloy calls attention to the recent paper of Desnos and to the fact that this is not at all a new remedy, but since its discovery by Desfosses in 1820 it has been the subject of study by Majendie, Husemann, and others. Formula, $C_{42}H_{87}NO_{13}$, crystalline, of bitter taste, insoluble in water, slightly soluble in alcohol; these characters are, indeed, well known. It is useful as a sedative of both the sensory and of the motor system. It has been used to combat the trembling in sclerosis *en plaques*, in tic douloureux, paralysis agitans, and post-hemiplegic hemi-athetosis. It is supposed to be a moderator of the motor excitation of the bulbo-medullary centre, of the lateral column, and of the pyramidal tract. It has been unsuccessfully administered in whooping-cough. Of late it has been recommended in the pains of dyspepsia, in gastralgia, in the pains of alcoholic gastritis, in gastric ulcer, and to avoid, in certain susceptible classes, the dangers of the morphine habit. The dose is from one to six grains per day in wafers, pills, or mucilage. In spite of the enthusiasm of recent writers, it is not likely that this remedy will come into extended use, because the place which it would seem that it should occupy is already filled by reliable remedies.—*Revue Générale de Clinique et de Thérapeutique*, 1892, No. 14, p. 217.

The Treatment of Epilepsy.

Dr. Guy Hinsdale has shown from his clinical observations that potassium bromate shares with the bromides the power of controlling epileptic seizures, but it is an irritant intestinal poison, lowering the pulse and depressing the heart to such a degree that in most instances it had to be abandoned. Magnesium bromide exerted an undoubted power in controlling the attacks, both as to frequency and severity; there was, however, apparently a greater liability to facial eruption than in the case of potassium or sodium bromide, and Fowler's solution of arsenic was usually given in addition. Hydrobromic acid was fairly successful; it is not likely to cause acne nor muscular depression, and, in some cases, it is usefully added to lessened doses of alkaline bromides. Certainly, in some instances, it does aid digestion or at least has no tendency to impair that function. The use of nitro-glycerin has not

been sufficiently encouraging to insure its continuance. In some cases, when the improvement was most striking at first, the attacks soon returned, and the remedy had to be abandoned. Nitrite of potassium proved too depressing and produced marked cardiac irritability. Antifebrin succeeded in keeping the attacks, in one case in which the bromides had failed, down to such a number that life was useful, but usually only temporary improvement was noted, and in a few weeks it was necessary to return to the bromides. Sulphonal was used in several cases with more or less unsatisfactory results, and appears to answer admirably as a substitute when the bromides have to be discontinued on account of bromism or other disagreeable complications. He has used sodium biborate, lithium biborate, tincture of cannabis indica, tincture of digitalis, ammoniated copper, and antipyrin, but none of these remedies maintained themselves. He has fallen back, then, upon the bromides of sodium, potassium, and lithium, employing most frequently the sodium salt, which is well borne for long periods, when arsenic is used occasionally to check cutaneous disturbances.—*International Medical Magazine*, March, 1892.

Actæa Racemosa in Dysmenorrhœa and Ovarian Irritation.

Mr. James Brunton uses this remedy in twenty to thirty minim doses, thrice daily, for four days previous to the usual time of the appearance of the flow. It is supposed to have an anodyne action upon the dysmenorrhœa, whether of uterine or ovarian origin, and in certain cases of metrorrhagia it can replace ergot to advantage. In amenorrhœa of early girlhood it is of benefit when combined with iron. As an anodyne it can replace the bromides and opiates. In menorrhagia and metrorrhagia it is beneficial as a regulating agent, although at times it is disappointing.—*The Practitioner*, 1892, No. 286, p. 625.

The Treatment of Hepatic Colic by Glycerin.

Dr. Ferrand has reported a number of observations which show the advantages of glycerin over oil in the treatment of hepatic colic. It is a cholagogue of itself, and can be more easily administered, and is better tolerated, even to daily doses of an ounce. Administered with the same quantity of chloroform water it is better borne, and, as well, more efficacious. In the intervals it should be given in smaller doses, one to three teaspoonsful in one-half glass of alkaline water, as, for example, in Vichy. He concludes that when administered by the stomach it is absorbed by the lympatics; it is a powerful cholagogue; a massive dose of one ounce will determine the crisis; a moderate dose of one to four teaspo onfuls in an alkaline water will prevent fresh attacks; without being a so lvent for calculus, it is a valuable remedy for cholelithiasis.—*Les Nouveaux Remèdes*, 1892, No. 7, p. 147.

The Therapeutic Action of Kola.

Dr. F. Combemale presents an exhaustive study of this remedy, which contains 2.348 per cent. of caffeine (Heckel and Schlagd enhauffen). Dujardin-Beaumetz has used it with good results in cardiac asystolia; Huchard

believes it to be valuable in cardiac diseases when there is weakness of the myocardium ; it is certainly useful, in the diseases of the heart, as a diuretic. As Fonssagrives has pointed out, this is a true tonic, not only so far as concerns muscular effort, but as well, intellectual work. It may replace quinine in adynamic diseases and can be associated with alcohol in the treatment of infectious diseases. It is valuable in neurasthenia, and in convalescence from epidemic influenza. Firth believes it to be of the greatest value in treating alcoholism. Hamilton asserts that it is a remedy against certain symptoms of sea-sickness (depression, vomiting, vertigo). Chambord-Hénin has used it with brilliant success in a case of confinement, when it prevented syncope. In can be administered as a tincture or a fluid extract, with equal parts of the same preparation of coca. According to Huchard, thirty drops three or four times daily, but not at night, because of the insomnia which it causes.—*Bulletin Général de Thérapeutique*, 1892, 8e. liv., p. 145.

Acute Poisoning by Phenic Acid.

Dr. Couteaud reports two fatal cases. He considers the result to be due: 1. To traumatic shock from severe pain arising from the burning of large visceral surfaces; this pain undoubtedly increased by the imminence of death. 2. To a condition of syncope and the phenomena of inhibition, which are due to respiratory paralysis (at least in part), gastric paralysis, and indeed in one case to bulbar paralysis. 3. To a diffusion of the poison into the blood, preventing the oxidization of the corpuscles, giving to the nervous centres a pathological blood. 4. To asphyxia, such as above-mentioned, then also respiratory paralysis from mechanical obstruction of the bronchi.

For the treatment in these cases the sulphate of soda is usually recommended as the best antidote, but its administration must be immediate, and it is also important that the acid should be at once neutralized by a base; lime, which is almost always at hand, best fills this indication. But to meet the indications cited under the above divisions, no remedy presents much hope. Even should the individual escape immediate death, the condition of the respiratory passages causes grave anxiety, and the gloomy prospect of perforation of the stomach and stenosis of the œsophagus are equally of serious import.—*Gazette hebdomadaire de Médecine et de Chirurgie*, 1892, No. 14, p. 159.

The General and Local Treatment of Tuberculosis by Inhalation.

Dr. I. Neudörfer, after discussing fairly Prof. Koch's discoveries and arriving at a just estimate of their present failure when measured by the requirements of the practical physician, comes to an exemplification of his own method. The advantages are: (1) that its application is not limited by age, sex, or condition; (2) that a marked improvement is clearly manifest after eight to fourteen days' treatment. Although he does not believe that there exists a specific for tuberculosis, yet there are many remedies that favor the cure of this malady, and indeed that it is a curable one, basing this opinion upon bacteriological and upon empirical-clinical evidence. The remedies upon which reliance must be placed should be not only harmless but

beneficial to healthy and diseased lungs; they should be capable of reaching the seat of the difficulty and should have an influence in preventing the growth and increase of tubercle bacilli, and indeed to destroy them, and also to give the organism opportunity to remove them. Believing that the ideal therapeutics of pulmonary tuberculosis consists in the administration of remedies by inhalation, he figures an apparatus which allows the remedy to be inhaled through the nose, but prevents the mingling of the expired with the inspired air. To this apparatus can be attached another for the atomization of liquids, or for inhalation of liquids dropped upon cotton, the latter being more particularly intended for anæsthetics and analgesics. When chloroform is used an automatic dropper is placed in connection with the cotton-retainer. As the result of experimentation with a large number of substances, he concludes that the number, depth, and rhythm of the respirations should be regulated by the physician—fifty or sixty respirations, at one or possibly two daily sittings, interrupted if necessary, which, however, should not be more than ten minutes in duration. He recommends several formulæ, chiefly combinations of creasote, guaiacol, phenocoll, piperazin, with ether, chloroform, or bitter almond water.—*Wiener Klinik*, 1892, Hefte 4, 5, S. 95–174.

[This is a valuable contribution, almost a monograph, to a subject that always excites interest. The argument is logical, the statements temperate, and it is well worthy of a careful perusal.—R. W. W.]

Anæsthesia by Cocaine.

Dr. L. G. Richelot reviews the discussions of 1891 before the Société de Chirurgie, carefully weighing the opinions of Reclus, Berger, Schwartz, Regnier, Moty, and Trélat. Recognizing the advantages, the economy of time, absence of vomiting—but stating fairly the great disadvantage, the absence of sleep, which permits the patient to know all details—he believes that its harmlessness has not been absolutely demonstrated. He uses a 2 per cent. solution, twenty-five to thirty grains, believing it to be the best of the local anæsthetics, but its harmlessness as compared with chloroform must be determined.—*L' Union Médicale*, 1892, No. 46, p. 545.

Two Cases of Tetanus Treated by Injections of Antitoxic Blood. (Method of Behring and Kitasato.)

M. L. Rénon has observed in the service of Professor Dieulafoy two fatal cases of tetanus, but ten days intervening. The injections of defibrinated blood of rabbits, rendered immune against tetanus, were made by MM. Vaillard and Roux. In spite of the fact that these cases resulted unfavorably, it is believed that this report may render assistance in determining the proper dosage. Tizzoni reported his case in August of last year, followed by another in November by Nicoladoni, a third by Gagliardi, the fourth by Pacini, all being successful; the only fatal case, previous to the present ones, is that of Baginsky and Kitasato in January, 1890. Tizzoni believes that rabbit serum is more efficacious than that of dogs. The fatal results in these cases are to be attributed to the greater gravity of the disease and the longer duration of it

before treatment was instituted. Success requires early treatment and large doses, although the necessity of applying the remedy at an early date detracts much from the value of the treatment. The injections appear to be entirely harmless, and to have afforded a prompt, although temporary relief.—*Annales de l'Institut Pasteur*, 1892, No. 4, p. 231.

A Case of Chorea Treated by Chloral Hydrate.

Mr. B. Baskett reports a case of a girl of fourteen years who was suffering from rheumatism accompanied with chorea. The attack was her first, and was mainly right-sided. Improvement followed rest and the use of salicylate of soda, subsequently Fowler's solution. Becoming furiously excited, with incessant movement, she was chloralized, the necessary daily amount being about one hundred grains, until complete cure resulted.—*Lancet*, 1892, No. 3580, p. 796.

The Treatment of Pleurisy.

Dr. P. Duroziez ably argues that the treatment of this disease is something more than the treatment of the exudation; it is the treatment of the diseased pleuræ. Since pleurisies do not exist alone, often connected with bronchitis, or pulmonary accidents, not rarely with abdominal symptoms of typhoid character, consequently the treatment must vary according to circumstances. Of ninety-five cases treated, eleven died; in nine instances the necropsy showed evidence of tuberculosis in three cases only, and those were of the male sex. These figures do not establish the superiority of any treatment above another. Although he believes strongly in antiphlogistic treatment, yet bleeding is not indicated for this generation. In the cases cited, nine in number, the treatment was sufficiently varied.—*L'Union Médicale*, 1892, No. 62, p. 735, and No. 63, p. 751.

Rectal Antiseptic Injections in Epidemic Influenza and in Advanced Phthisis with Large Cavities.

Dr. T. C. Voigt has treated over fifty cases in which he has made use of this method. He uses a drachm of pure oil of eucalyptus globulus mixed with about an ounce of warm olive oil, administered every two hours. When improvement sets in the dose is reduced to one-half drachm and the interval lengthened. He believes that the antiseptic action of eucalyptus oil is efficacious in cutting short the attack of influenza and in preventing altogether that nervous prostration and general breakdown which accompany and follow the disease, provided, always, that one is called to the case at a sufficiently early stage of the illness, and that there is no contra-indication in the state of the heart or kidneys.—*Lancet*, 1892, No. 3850, p. 795.

On the Value of Methylene-blue in Malarial Fever.

Dr. W. S. Thayer, after reading the results of the experiments of Guttmann and Ehrlich, treated seven patients systematically, and arrived at about the same conclusions as Myer. 1. Methylene-blue has a definite action

against malarial fever, accomplishing its end by destroying the specific organism; but it is materially less efficacious than quinine, falling to accomplish its purpose in many cases when quinine acts satisfactorily.

2. The action appears to be rapid, the chills disappearing and the temperature, in the remittent cases, falling to normal during the first four or five days; but later, however, if a sufficient number of organisms have resisted the drug, they appear to develop again directly under its influence, causing a return of the symptoms.

3. Methylene-blue seems to have no advantages over quinine which would warrant its further use.—*Bulletin of the Johns Hopkins Hospital*, 1892, No. 22, p. 49.

The following papers are worthy of mention:

"Local Asphyxia of the Extremities," by PROFESSOR PETER, in *Revue de Thérapeutique Générale et Thermale*, 1892, No. 4, p. 49. Topical electrical salt-bath, the negative pole.

"Preventive Inoculation and Bacterio-therapie," PROFESSOR POTT, in *Therapeutische Monatshefte*, 1892, No. 1, S. 1; No. 2, S. 70. A careful and exhaustive review.

"On the Value of Parenchymatous Salt-water Injections in Acute Anæmias," by DR. KORTMANN, in *Deutsche med. Wochenschrift*, 1892, No. 16, S. 356. A careful study of the literature. Uses twenty to forty ounces of a six-tenths of 1 per cent. solution of table salt, reporting five cases. Believes it well adapted to take the place of transfusion, to be simple, and without danger.

MEDICINE.

UNDER THE CHARGE OF

W. PASTEUR, M.D. LOND., F.R.C.P.,

ASSISTANT PHYSICIAN TO THE MIDDLESEX HOSPITAL; PHYSICIAN TO THE NORTHEASTERN HOSPITAL FOR CHILDREN;

AND

SOLOMON SOLIS-COHEN, A.M., M.D.,

PROFESSOR OF CLINICAL MEDICINE AND APPLIED THERAPEUTICS IN THE PHILADELPHIA POLYCLINIC; PHYSICIAN TO THE PHILADELPHIA HOSPITAL.

A VARIETY OF SUGAR HITHERTO NOT OBSERVED IN URINE.

SALKOWSKI and JASTROWITZ (*Centralbl. f. die medicin. Wissensch.*, 1892, No. 19, p. 337) found, on heating with sodic hydrate and copper sulphate the urine of a man, twenty-nine years old, under treatment for morphinism, that a precipitate of yellow copper oxyhydrate was thrown down, while the fermentation-test and polarization-tests at times yielded negative results and at other times indicated the presence of sugar. The urine, that failed to

present the usual reactions of sugar, when heated for a considerable time with phenylhydrazin hydrochlorate and sodium acetate yielded a well-characterized osazone. If 100 c.cm. of the urine were heated with 2 gm. of phenylhydrazin hydrochlorate and 4 gm. of sodium acetate, on cooling in the course of twenty-four hours a thin, pasty mass resulted. The quantity of osazone present was small—about 3 gm. to 100 c.cm. of urine. This osazone is distinguishable from phenylglucozone by its boiling-point, as well as by its comparative solubility in hot water. It crystallizes from water as lemon-yellow, interwoven needles of silky lustre, melting at about 157° or 158° C.

Exalgine in Graves's Disease.

Dr. T. Churton, of Leeds, records the following case (*Lancet*, 1892, No. 3587): A woman aged twenty-eight years, of fair complexion, having typical Graves's disease, had, after some months, extreme exophthalmos and congestion of both conjunctivæ, with ulceration of the left cornea. Leeches, lotions, etc., gave very little relief. At length, the pain becoming severe, exalgine was tried, half a grain dissolved in five minims of spirit of wine, and a tablespoonful of water, every half-hour for three times when pain was present. Next day not only was the patient free from pain, but the congestion had entirely disappeared; the eyes had changed from flaming red to perfectly white. During the next month, to satisfy himself and several critical observers as to the influence of exalgine, experiments were made; all the other drugs and appliances were tested in turn. The result was always the same: when exalgine was given the eyes were white; when it was omitted they became red and painful within a day, no matter what other drugs were given or lotions applied. As upon trial being made it seemed that the good effect was less marked when the whole dose of a grain and a half was given at one moment than when it was given in divided doses—half a grain every quarter of an hour for three times—it was ordered to be taken regularly in this manner every four hours.

Hemorrhagic Nephritis, or Blood Tumor of the Kidney.

Dr. Thomas Oliver (Newcastle) records under this title a case of some interest (*Brit. Med. Journal*, 1892, No. 1630). A young woman, aged twenty-three years, was admitted to hospital complaining of pain in the chest and a swelling in upper part of right chest, of one month's duration. Her mother had died at thirty-eight of cerebral hemorrhage—beyond this the family history was unimportant. The onset was quite sudden and attended with severe pain. The lump below right clavicle was noticed a few days before admission. She was well nourished. On admission she complained of distressing palpitation, and had an anxious expression. Between the first and second cartilages near the sternum was a tumor as large as half a billiard-ball, pulsating synchronously with the heart, slightly expansile, and dull on percussion. Pulse hard; cervical veins distended; temperature 101°; breathing quickened.

A few days after admission the urine, with a specific gravity of 1012, was

found to contain one-eighth albumin and many granular casts. Right pupil larger than left, discs normal.

Within three weeks the tumor ceased to pulsate, and fluctuation was detected in it. Epistaxis now supervened and recurred several times. Shortly after there was a sharp attack of pericarditis, which yielded rapidly to treatment. The sternal tumor continued to diminish in size, and yielded blood and pus when explored with a fine syringe. Improvement was maintained for about a fortnight, when she experienced severe pain in the right side of the abdomen. A large swelling was found to have suddenly formed over the seat of the right kidney. Constant vomiting was now a prominent symptom. Hæmaturia appeared and lasted for one week. Fluctuation became apparent in the abdominal tumor, from which some dark blood was removed by an aspirating-needle. The temperature now oscillated irregularly, at times reaching 103°, and pericardial friction with pain and dyspnœa recurred at intervals. Œdema of the feet gradually developed; the grasp of the right hand became weak, and with tingling sensations in the hand; being followed by complete paralysis of the flexors of the right fingers, with anæsthesia over the area supplied by the median nerve. From this date onward there is a record of recurrent pericardial attacks and epistaxis, gradual diminution of urine and extension of œdema, ending in fatal coma.

Necropsy.—On reflecting skin of chest no trace of cyst-cavity could be made out. The right lung was adherent to the chest-wall near the sternum, and to the pericardium. Pleura contained fluid—dark and blood-stained. Nothing was noticed in the pleural cavity which could explain the pulsating tumor on the chest-wall. Both lungs were œdematous. Pericardium was generally adherent to the heart. The wall of the left ventricle was thick; cavity slightly dilated; valves healthy. Bronchial glands cheesy. The abdomen contained a large quantity of coffee-colored fluid.

Occupying the right lumbar region was a tumor the size of a cocoanut, firmly adherent to the intestines. On removal it was found to be the kidney, which had undergone alteration, nearly the whole of the tumor being composed of blood lying loosely or in small loculi. Very little kidney structure remained save a delicate gray streak at the periphery. The left kidney was extremely contracted, although the capsule was easily removed, leaving a granular surface behind it. The liver was nutmeg, with small masses of yellowish-white substance around the biliary canals (cirrhosis).

On microscopical examination of what is left of kidney structure in the renal hæmatoma, there is observed very marked tubular nephritis. The secreting cells are very much enlarged and granular, and at places are breaking down, the débris occupying the interior of the tubule. The Malpighian glomeruli are enlarged; their capsule is thickened. At places the interstitial tissue is increased. Here and there in the section the fibrous tissue is so much increased and laminated that it looks as if it was composed of shrunken compressed tubules. It is this thickened tissue that forms the lining of the cyst which contains the blood; the other part of the section simply shows blood-clot, blood-cells, and blood-crystals. The left kidney is the seat of interstitial nephritis.

"The pathology of this case is somewhat obscure. Can it have been one of masked hæmophilia? The development of a blood tumor in the chest-

wall, the recurrent epistaxis and hæmaturia, and the presence of blood in the pleural cavity and in the right kidney—all these suggest this as a possible explanation. Against these must be placed, however, the absence of bleeding in the family history, although it is to be remembered that patient's mother died of apoplexy (cerebral hemorrhage?) at the age of thirty-eight, and the existence of left-sided interstitial nephritis and biliary hepatitis in the patient herself. Disease of the kidney, by attenuating the blood, may have allowed it to ooze more easily out of the bloodvessels, and thus a tendency to bleeding became established, which was not without its influence in hastening the fatal termination."

Circumscribed Tuberculous Pachymeningitis.

Gussenbauer (*Wiener medizin. Presse*, 1892, No. 16, p. 643) has reported the case of a man, twenty-one years old, with a tuberculous family history, who, four weeks after a blow in the right parietal region, without loss of consciousness, without abrasion, without extravasation of blood, without notable pain, was seized with severe pain in the region of the injury, followed by fever and chills. Shortly afterward diplopia developed, pain was also felt at the nape of the neck, and a lymphatic gland in the left nuchal region became enlarged to the size of a pea. Eight weeks after the accident, a soft painful tumor formed at the site of injury, while repeated chills occurred. The swelling attained the size of a hen's egg, the pain, the diplopia, and the sleeplessness gradually disappearing. The tumor was incised, and pus and necrotic tissue escaped. The febrile attacks ceased, although the suppuration continued, a fistula persisting. A considerable defect of bone resulted, and the pulsation of the brain could be felt. From the course of the affection, the persistence of a thin, purulent discharge, the tuberculous heredity, and the signs of an area of condensation in one lung, a diagnosis of primary circumscribed tuberculous pachymeningitis was made, which was confirmed by an operation. A fungous mass, as large as a hen's egg, was found seated upon the dura mater. The growth was removed by means of a sharp spoon. The wound was irrigated with 1 : 1000 sublimate solution, its surface dusted with iodoform, and its margins approximated by suture. The patient recovered from the operation, and subsequently did well.

The Influenza.

Curtin and Watson (*Climatologist*, ii. 5, p. 77) present the results of observations made in some five or six thousand cases of influenza seen in the epidemics of 1889–90 and 1890–91. Their experience supports the view of the contagiousness of the disease. In a family or in a community, all escaped or many became victims. The contagiousness appeared to be feeble. Slight obstacles prevented direct transmission. Crowding seemed to intensify the degree of contagion. Catarrhal conditions of the respiratory tract were common. The bronchitis presented peculiarities: it was protracted in duration, sometimes lasting for months; it shifted its seat, successively invading all parts of the lungs; it was attended with the secretion of tough, viscid mucus, difficult of expectoration; in the second epidemic the sputum resem-

bled clear boiled or scalded starch or tapioca; sometimes it was frothy, sometimes black, as if from soot or coal-dust. The cough was irritative or explosive, sometimes resembling that of whooping-cough. Low-pitched râles were heard. The patient appeared to breathe, though the chest failed to expand, and the respiratory murmur was not detectable. The condition was thought to be dependent upon paralytic dilatation of the bronchioles and air-vesicles. Both croupous and catarrhal pneumonia were rarely seen. Insomnia was common. Delirium was rare during the febrile period, and was not aggravated. Insanity, transient or permanent, was encountered with relative frequency. Meningitis was not uncommon. Convulsions were rare, but loss of consciousness was occasionally encountered at the onset of attacks. Hemiplegia and paralysis of the arms and of the legs were observed in isolated cases; recovery was the rule. Headache was common. Vision was often impaired; in some cases hearing was deranged; paræsthesiæ were observed in numerous cases. Neuritis was rather common. Neuralgia was rare. The powers of generation were enfeebled. The senses of smell and taste were perverted, rarely lost. Spasmodic affections, such as hay-fever and asthma, apparently underwent improvement. Prostration and exhaustion were marked. The digestive system presented evidences of lack of tone. The circulatory apparatus manifested symptoms indicative of want of nervous influence. In many cases death was due to heart-failure. Hemorrhages from various mucous surfaces were common. In some cases chronic parenchymatous nephritis developed. Abortion was rarely induced. Pregnant women seemed to escape or to have mild attacks. Various cutaneous eruptions were observed in a considerable number of cases. The temperature ranged fairly high—between 101° and 105°. In mild attacks the temperature became temporarily subnormal. In a few cases the temperature was subnormal throughout. Relapses were most common in active middle life, in those exposed to cold, dampness, anxiety, and fatigue. In one case seven relapses were observed. The various and varied manifestations seemed best explicable by a condition of vasomotor paralysis dependent upon the presence of a microbe in the blood.

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

PROFESSOR OF CLINICAL SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE UNIVERSITY AND GERMAN HOSPITALS;

ASSISTED BY

A. C. WOOD, M.D., INSTRUCTOR IN CLINICAL SURGERY, UNIVERSITY OF PENNSYLVANIA; ASSISTANT SURGEON, UNIVERSITY HOSPITAL.

AND

C. L. LEONARD, M.D., ASSISTANT INSTRUCTOR IN CLINICAL SURGERY IN THE UNIVERSITY OF PENNSYLVANIA.

THE MANAGEMENT OF COMPOUND DISLOCATIONS OF THE ANKLE-JOINT.

SCUDDER (*Boston Med. and Surg. Journ.*, vol. cxxvi., No. 14) gives the following outlines for the treatment of these injuries: "1. If the laceration is

so great that the foot is useless, amputation is necessary. Amputation is indicated in but two other instances—old age and sepsis. 2. If the laceration is not great, and the dislocation can be reduced, it should be reduced without excision; proper drainage being provided both anterior and posterior to the joint. 3. If the laceration is not great and reduction impossible, then an excision should be done, either partial or complete. 4. If there is great injury to bone, whether the dislocation can or cannot be reduced, a partial or complete excision should be done." He reports a recovery after reduction and antiseptic treatment of a dislocation with extensive laceration which involved the dorsalis pedis artery and the anterior tibial tendon; there was ankylosis, but no shortening.

Post (*Ibid.*) reports two cases of dislocation with laceration in which, after antiseptic cleansing, an antiseptic gauze and plaster dressing was applied to fix the joint. In the first case the temperature rose to 101° on the two successive evenings, but afterward fell to normal. The first dressing was done on the thirteenth day, when the wound was healed, except a small granulating surface; the plaster dressing was replaced, and on the thirty-third day the wound was found to be perfectly healed. The patient had but a slight limp and no shortening. In the second case there was considerable comminution of bone; the fragments were removed, the wounds in the periosteum and skin sewn, and a dressing similar to the first applied. The first dressing was on the fourteenth day, when slight external sloughing was found, but the patient made a good recovery with a normally movable joint. "The principal point in the treatment of these cases was the disinfection of the wound, but the immobility, as secured by the plaster bandage, was almost of equal importance."

Three Recent Cases of Œsophagotomy.

Gay (*Boston Med. and Surg. Journ.*, vol. cxxvi., No. 14) adds the following interesting cases to the literature of this subject:

Case I.—Child, aged three and a half years. A coin three-quarters of an inch in diameter was removed from the lower end of the œsophagus through a lateral incision in the neck; recovery in thirteen days. In perfect condition when seen twenty-five days after operation.

Case II.—Male, aged twenty-eight years. Four false teeth with plate were removed from the œsophagus four inches below the top of sternum, through a lateral incision; the wound was closed with silk sutures, but was opened on the third day and found to be septic, but not suppurating. Patient died on fifth day in typhoid state. Death was due to septicæmia and exhaustion. He thinks the open method with free drainage preferable, though he had succeeded in a former case with the method used.

Case III.—Male, aged forty-eight years. Œsophageal stricture eight inches from incisors; impossible to pass bougies; œsophagotomy; intubation through the stricture, the entrance being found one inch above the bottom of the sac on its anterior wall. Patient improved, left hospital a month after operation, but returned to die from exhaustion and emaciation three weeks later, his life having been relieved of suffering and lengthened two months by the operation, which was justifiable as a palliative measure.

A Case of Torticollis due to Hæmatoma of the Sterno-mastoid Muscle.

Lovett (*Boston Med. and Surg. Journ.*, vol. cxxvi., No. 13) reports the following case. The patient, six weeks old, showed a tumor the size of a hazel-nut, confined to the left sterno-mastoid muscle, which was then slightly contracted, turning the head to the right. The position could be corrected, though not beyond the normal. On general treatment the tumor gradually disappeared. When seen eighteen months later, marked torticollis was present, distinguishable from the routine case only by its history. The contraction of the sterno-mastoid had increased, the position could not be corrected, and there was some asymmetry of the eyes.

Reflexes in Hip Disease.

Brackett (*Boston Med. and Surg. Journ.*, vol. cxxvi., No. 13) draws the following conclusions from the comparative study of forty-seven cases of hip disease and twenty-one of spinal caries. The condition of the reflexes of the patella tendon depend on the same general causes as the muscular spasm. When muscular spasm is absent the reflexes are not altered. If, however, the joint is irritable we may expect to find the reflexes increased on the diseased side. "The presence of subjective symptoms does not apparently affect the phenomenon. The value of this is twofold: it becomes an indication of the irritability of the joint, in the absence of subjective symptoms, in the same way as does the involuntary muscular spasm, and also of diagnostic value in the early stages in the absence of other indications. In this it can be used as one of the evidences in distinguishing between early hip and low lumbar caries, for a marked difference is shown in the case of spinal caries in this matter of reflexes, as these show an almost constant uniformity, and are not only equal, but much less likely to be exaggerated even with the presence of other disease." In old cases with marked atrophy the value of this sign is doubtful. It is simply one valuable sign in determining the condition of the joint, but not an infallible one.

Tuberculous Herniæ.

Sprengle (*Centralbl. für Chir.*, 1892, No. 8), reviewing an article by Jonnesco on "Tuberculous Herniæ" (*Rev. de Chir.*, 1891, Nos. 3 and 6) criticises the author's division of only eleven cases collected into (1) tuberculosis of the hernial sac, (2) of its contents, and (3) of the contents and sac, declaring that they are only the stages which can be found in all tubercular disease of that region. He also differs from the author in the view that this is an especially favorable position, on account of the blood stasis present, for the development of tuberculosis. Jonnesco contradicts himself in his article by stating that this is a very rare position for tubercular disease, and furthermore, accounting for this rarity by claiming that hernia is found more frequently in men of arthritic than in those of tubercular diathesis, dividing them according to this seemingly popular French hypothesis. In speaking of the author's clinical division of herniæ into latent, painful, and inflam-

matory, the latter complicated by strangulation or becoming irreducible, Sprengle says it is scarcely necessary to remark that there are symptoms distinctly different that divide these latter and make two separate clinical divisions. He then quotes Jonnesco as saying that the diagnosis must be made from the ordinary and the carcinomatous forms of hernia, and that the indications for operation are those common to ordinary herniæ and call for herniotomy or other operation for radical cure; and in addition for the removal of the tuberculous disease. If this latter is indicated and extirpation is possible, it should be done even if it require resection of the intestine. The view is advanced that simple herniotomy may produce the same beneficial results as have followed exploratory laparotomies in tubercular peritonitis, and if the disease has extended into the peritoneal cavity, a laparotomy is indicated.

Severe Head Injuries—Recovery.

Reid (*Australian Med. Journ.*, vol. xiv., No. 2) reports the following case of uninterrupted recovery after undoubted fracture of the base of the skull. E. S., aged twenty-five years, a strong healthy woman, was thrown from a cart, striking directly upon her head. When seen there were present symptoms of shock and concussion, and in addition blood-stains on both nostrils, but no discharge. A linear depression could be seen and felt, extending from the upper and outer part of left parietal eminence to centre of left upper orbital margin, indicating a fissured fracture of that region. There was ecchymosis of left upper eyelid, with protrusion of the eyeball and subconjunctival ecchymosis, showing involvement of the orbital plate. There was a watery discharge, blood-stained and frothy, from the left ear, and although the patient breathed with mouth open, air was found to be puffed out freely with each expiration; this symptom the author would account for by a fracture of the petrous bone, extending from its cerebral to its inferior aspect and communicating with the pharynx by a wound of the mucous membrane, and he believes the continuous vomiting of dark grumous blood to have been due to the communication established by this wound between the pharynx and the petrosal fissure. The patient continued comatose with bloody emesis at lengthening intervals for twenty-four hours, regaining entire consciousness after forty-eight hours. A copious clear discharge containing sodium chloride continued for nine days from the left ear. The temperature was about normal, with the exception of one rise to 103°. There was no paralysis observed, and she was out of bed in five weeks, the only permanent damage being total deafness on left side, even to bone-conduction, which he believes to be due to injury to the auditory nerve and rupture of the tympanum. The treatment was rest, ice to the head, laxatives, and iodoform blown into the ear.

Treatment of Varicose Veins of the Leg, Complicated by Ulcers.

Maylard (*Glasgow Med. Journ.*, vol. xxxvii., No. 3) gives the following as a successful method of treating sluggish ulcers of the leg. He says:

"By antiseptic solutions the surface of the ulcer is cleansed, and it and the surrounding parts are rendered healthy and active by the daily applica-

tion of massage. So soon as I have reason to believe that the ulcer is a healthy, healing wound, the matter of operation is considered. The skin over and around the portion of vein that is to be removed is prepared in the usual way. An incision is carried through the skin along the whole length of the portion of vein to be excised. When exposed, it is dissected up, ligatures applied around each radicle of the varicose trunk, and the trunk itself tied above and below. The skin wound is then stitched up carefully and dressed antiseptically."

He considers the operation to be justifiable and harmless, if the patient is properly prepared and thorough antisepsis is carried out. In the three cases which he uses as illustrations, the wounds healed by primary union, with no rise of temperature after operation; the ulcers healed and remained firm, with no sign of recurrence months after operation.

The Toxic Action of Impure Chloroform.

DuBois-Reymond (*Brit. Med. Journ.*, No. 1622) says that the difference found between the physiological action of pure chloroform produced by Pictet's process of refining, as opposed to that of the impure residue from that process, is as follows:

1. No difference was found in the pulse-waves nor in the frequency of respiration; the former being equally affected by both forms of the drug, the latter varying considerably. 2. The pulse-rate, compared in nineteen cases, is higher at the close of the experiments with residue than of those with pure chloroform. 3. The blood-pressure in by far the greater number of the experiments at the moment the respiration stops is higher after inhalation of pure chloroform than after inhalation of the impure residue. 4. The residue causes stoppage of respiration much more quickly than pure chloroform.

These experiments, conducted with chloroform refined by Pictet's process, from what is considered pure chloroform commercially, show how necessary is the testing of chloroform before its use, as even the best, commercially, is impure.

The Function of the Thyroid Gland.

After an elaborate historical study of the theories which have been pronounced concerning the thyroid gland, and a discussion of the nature of its tissues, Horsley (*Brit. Med. Journ.*, No. 1622) concludes "that the thyroid gland is a structure essentially connected with the metabolism of the blood and tissues; that in fulfilment of its functions it is hæmapoietic both directly and indirectly, and that it secretes from the blood a colloid substance, which is transmitted *viâ* the lymphatics from the acini of the gland to the circulation;" and further, "that the thyroid gland is in functional activity before birth, and is of special metabolic importance in early extra-uterine life, while its value diminishes as the general vital processes increase." Indirect evidence affords very weighty testimony in favor of the view that the thyroid is, in truth, the important organ of metabolic influence that the general results of thyroidectomy would lead us to believe it to be.

Systemic Antisepsis and the Mercurial Salts.

Lereboulet (*Gaz. hebd. de Méd. et de Chir.*, 1892, No. 9) reviews an article in which Robin concludes: 1st, that systemic impregnation by mercurials is impossible; 2d, that its internal administration does not prevent or decrease, but rather facilitates the action of the microbes of infectious pneumonia; 3d, that in no case can we judge from cultures in glass of the action of drugs upon microbes in the body, but only through cultures and experimentation upon animals. Lereboulet says these conclusions compel us to acknowledge the absolute inefficacy of sublimate as anything but a local antiseptic, and asks if we must apply this reasoning to all antiseptics which we hope to use systemically, understanding by systemic antisepsis the impregnation of the entire system by a substance toxic to microbes, and introduced either by the mouth or by hypodermic injections. Must we conclude that internal antisepsis is impossible, and condemn the attenuated animal virus, not to mention the *toxines* or products of microbic secretion, which, without destroying, hinder perhaps the action of bacteria? Do we not know remedies which eliminated by the lungs act upon the tubercular lesions? Does not creasote act sometimes in this manner, and do not the antiseptics, though insoluble, render daily service in the stomach and intestines? He says we must not be discouraged, and must try to find methods that will destroy the noxiousness of antiseptic toxines or that will so act upon the living cell as to make it resistant to the pathogenic microbe. In this connection he mentions briefly the paper of d'Arsonval upon the preparation of liquids derived from the different tissues of the body to be used as medicaments. This he says is an attempt to institute a new therapy whose value can only be determined by long and careful experimentation. These experiments are being carried on by skilled observers under the instruction and with the liquids prepared by Brown-Séquard and d'Arsonval, and if they prove what has already been declared by Paul, the value of the discovery cannot be denied.

Aneurism of the Ascending Aorta.

Weir and Page (*N. Y. Med. Journ.*, vol. iv., No. 19) report a case of aneurism which was treated without success by the needling method of Macewen, of Glasgow. Reviewing his work, they say: "Macewen not only scratched or irritated in each case, with the needle-point, the interior of the aneurism, but left the needle impinging on the opposing wall for periods varying from twenty-four to forty-eight hours; this not with the intent of obtaining coagulation on the needle, as in the older methods of treatment, but that the wall of the aneurism might be more thoroughly roughened."

This method Weir applied in three sittings. He used needles varying in size from one-half to one and one-fifth millimetres in diameter, their length being six inches, and found the larger to be the more efficient, but he allowed them to remain *in situ* only for about forty to fifty minutes, as the walls of the aneurism were considered to be too thin for safely leaving them longer. The largest area scratched did not exceed, at any of the sittings, the palm of the hand. No serious symptoms were shown by the patient; there was

slight spouting of blood after the withdrawal of the larger needles, but it was easily controlled by the finger. There was also some coughing with expectoration of blood, probably due to the wounding of the lung posteriorly. The patient died two months after the last operation, treatment being discontinued at the desire of his relatives. The post-mortem showed but slight deposits of leucocytes and fibrin, and the results of the treatment were so far negative. The aneurism was six inches and one-half by eight inches, springing from the ascending aorta, and its walls were extremely thin.

[Reference to Macewen's original paper will show that he does not attempt to "roughen" the internal wall of the aneurism and thus to produce either coagulation or deposition of fibrin. White thrombi are prone to form in the interior of a vessel at a spot where irritation has been induced and from which the endothelium has been removed. In an aneurismal sac this may be done by irritating the wall of the aneurism in such a way as to induce infiltration of the parietes with leucocytes, and a segregation of them from the blood-stream at the point of irritation; the irritation ought to be sufficient to set up a reparative action. In Macewen's cases the pins were left in for hours, in one case for forty-eight hours, which period he thinks should never be exceeded.

In the above case the shortness of the time during which the pins could be left in the aneurism, the size of the latter, and the thinness of its walls sufficiently explain the lack of success. Although Macewen has expressed the hope that the method would not be indiscriminately employed in every case of large aneurism, careful records by such good observers as Drs. Weir and Page, even in unsuccessful cases, will add to our knowledge of this important subject.—J. W. W.]

A Case of Loose Body in the Knee-joint due to Detachment of Articular Cartilage.

In the *British Medical Journal* for May, 1892, Burghard records the history of a young man aged twenty-four, who, in vaulting a gate, received a violent blow on the knee by the top rail. Motion of the joint caused a sharp pain, "like pins and needles running into the knee." The limb became swollen and discolored, and the patient was confined to bed. When seen by the author, three days later, there was much synovial effusion. On palpation an acutely tender spot was found over the inner condyle. When the swelling had subsided sufficiently, slight crepitus was detected over the tender spot, which at a later day was found to be due to a movable body at the inner edge of the articular cartilage of the femur about opposite the middle of the patella. Detachment of a piece of articular cartilage was diagnosticated, and arthrotomy performed. Immediately upon opening the capsule of the joint, the loose fragment presented. It measured $\frac{3}{4}$ by $\frac{1}{2}$ inch.

Exclusive of synovial apoplexy, masses of effused fibrin, and tuberculous disease, loose bodies in the knee-joint may be divided pathologically into three groups: 1. Osteo-arthritis. Of sixty-nine cases of which the author has notes, symptoms of this disease were present or developed in fifteen. 2. Direct detachment of articular cartilage by violence. The case reported belongs to this group. 3. Changes in the synovial membrane not due to

osteo-arthritis. The latter group embraces the cases that arise spontaneously or follow some considerable time after injury. The author believes that injury is an important etiological factor. Of the sixty-nine cases, there was a definite history of injury in thirty-six.

DERMATOLOGY.

UNDER THE CHARGE OF

LOUIS A. DUHRING, M.D.,

PROFESSOR OF DERMATOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

Peculiar Case of Pigmented Sarcoma of the Skin.

P. S. Abraham (*Brit. Med. Journ.*, Jan. 2, 1892) records, with a portrait, a rare form of sarcomatous disease, occurring in a woman aged fifty years, which closely resembled leprosy in its manifestation on the skin, for which it was mistaken by three medical men. The whole of the face and ears were the seat of nodulated growths, with broad bases continuous with one another, giving an undulating surface to the face, of a bronze color and shiny appearance. There was but little pain. On the trunk and extremities were spots slightly raised; those on the breasts and forearms were pigmented; those on the abdomen and legs were reddish. Two months later the face was enormously swollen into a purplish-brown, pudding-like mass, here and there ulcerated. The patient died, apparently from an attack of bronchitis, induced undoubtedly by exhaustion. For several weeks before death the swelling disappeared, her general condition improved, and it was even thought that she was going to recover. The growth was composed of small round cells, densely packed in places, much resembling those of lymphoid tissue, together with pigmented cells and scattered granules and masses of pigment. The author thinks that while it might be regarded by some as "granuloma," it favors more sarcoma, and that the case differs both from "mycosis fungoides" and from Kaposi's "idiopathic multiple sarcoma," which was the view also entertained by several distinguished dermatologists.

Syphilidiform Erythema.

A. Fournier (*Rev. gén. de Clin. et de Thérap.*, 1892, No. 8) describes an erythematous disease of the skin occurring in infants between the ages of three and eight months, which is often confounded with syphilis. In most cases it appears in those who suffer with diarrhœa, and occupies the genital region and the thighs. It begins as a papulo-vesicle, resembling closely a vaccine papule. In the second stage the centre becomes depressed, the vesicle ruptures, the surface is eroded, and may resemble a moist papule. A second crop of lesions usually appears at the end of a few days, undergoing the same

changes as the first. The disease is, in most cases, a local one, though the glands may become involved. The treatment should consist of cleanliness, a boric acid lotion, and dressing with zinc oxide, bismuth, or iodoform salve. The diagnosis is of the greatest importance.

The Value of Heat in the Treatment of Syphilis.

Aussass (*Journ. des Mal. Cut. et Syph.*, Jan., 1892) gives the case of a young man, aged seventeen, who had contracted the disease from a wet-nurse, and who for two years had suffered with persistent headache, which yielded neither to mercury nor to full doses of iodide of potassium. Daily hot baths in combination with mercurial inunctions were ordered, under which marked improvement followed in a short time.

Cod-liver Oil and Iodoform Locally in Lupus Vulgaris.

Zilgien (*Rev. gén. de Clin. et de Thérap.*, 1892, No. 3) reports the case of a woman, thirty-three years of age, who had a patch of lupus on her left cheek, which was cured by the curette. The right cheek then became in like manner diseased, upon which iodoform was used, but unsuccessfully, whereupon iodoform gauze, dipped in cod-liver oil, was applied as a dressing, which was daily alternated with simple iodoform powder, cicatrization taking place rapidly wherever the oil was applied.

Case of Dermatitis Tuberosa from Iodide of Potassium.

Dr. Holsten (*New York Med. Journ.*, April 23, 1892) reports the case of a child, aged sixteen months, who for bronchitis took two drops of a saturated solution of iodide of potassium every two hours; on the third day, light reddish-brown papules appeared on the face and extremities. The general health improved, and the bronchitis disappeared. In all, less than a drachm and a half of the drug had been taken. The papules became larger, raised, flattened, the color varying from pink to yellowish-brown, studded with minute whitish specks, from which, on puncturing, a thin, white fluid exuded. A week later the lesions on the leg had assumed a fungoid or cauliflower appearance, bathed in pus, and bleeding easily. The lesions seemed to heal more rapidly under an ichthyol lotion (10 to 30 per cent.) than under several other modes of treatment used. The author in his article reviews the subject of eruptions from the iodides, and gives a bibliography.

Case of Lymphangioma.

M. J. Epstein (*Journ. of Cutaneous and Genito-urinary Diseases*, June, 1892) reports (with two good photographs) a case of this rare disease. The subject was a woman, aged forty, a native of the United States. The disease was situated over the entire pubic region and lower portion of the abdomen and on the left buttock, consisting of a mass of small, pea- and bean-sized, pinkish, vascular papules and nodules, thickly studded, so as to form an elevated, tuberculated patch, the lesions resembling in form those of molluscum fibrosum or warts. Upon pricking the lesions, which had thick walls—con-

siderable clear, transparent, gelatinous fluid exuded for three or four hours. They filled up, itched, discharged, and dried up from time to time. The disease had existed sixteen years, and seems to be a typical example of lymphangioma.

Lupus Vulgaris: some Controversial Points.

J. F. Payne, the well-known London pathologist and dermatologist (*Brit. Journ. of Derm.*, vol. iii., No. 38), gives a *résumé* of some points which are the subject of controversy. The cause of lupus is some specific irritant or virus. The structure of the tissues shows that it belongs to the granulation new-formations, in which group of diseases there is a sort of living "thorn in the flesh"—an irritant continually acting at one or more points. In the tissues of lupus has been found, very sparingly, and often sought for in vain, a bacillus identical, in form, size, and relations to staining reagents, with the bacillus of tubercle. The disease may be regarded as a very slow and chronic form of the tuberculous process, remaining for the most part local, differing from other forms of tuberculous disease chiefly in its slowness, its feeble infectivity, and the paucity of tubercle it contains. The skin is not a favorable soil for this bacillus, which takes root here with difficulty, due probably to the lower temperature of the skin than that of the internal organs. As to the mode of infection, in some cases it occurs by direct implantation in the skin by wound or otherwise; and attention is called to another possible hypothesis—that of direct inheritance, or an inherited predisposition to be attacked by the bacillus.

Favus and its Treatment.

Dr. Sheldon G. Evans, U. S. N. (*Medical Record*, April 30, 1892), gives the results of treatment of one hundred and thirty-nine cases of this disease, occurring aboard ship, with few exceptions all the cases being among the apprentice boys. The origin of the disease was traced to an apprentice boy from Germany. The cases are not detailed, but the disease seems to have manifested no peculiarities. The treatment (which was suggested by the senior medical officer of the ship, Dr. Price) was eminently satisfactory. The hair was cropped short and kept so during the treatment. The effective remedy was an alcoholic solution of bichloride of mercury (1 : 500), applied with stiff brushes, the scalp being scrubbed with the solution every other day for a week or ten days, and then bathed twice a week with a solution of the same strength prepared with water and glycerin. When the scalp became inflamed mild sulphur or mercurial ointment was used. The cases all improved rapidly, many were entirely cured, and none developed a second attack.

Pilocarpine in Diseases of the Skin.

Robert M. Simon (*Birmingham Medical Review*, February, 1892) discusses this subject briefly, and gives favorable results from the use of the drug in a case of chronic eczema with great thickening and pigmentation of the skin, occurring in a man who had suffered much for fifteen months. In all, he had received 110 hypodermatic injections, of $\frac{1}{8}$ or $\frac{1}{6}$ grain each, twice daily, the

treatment being from time to time interrupted, and was cured. He suffered no local or general discomfort from the remedy. In pruritus senilis good, though only temporary, results were obtained from the drug. In psoriasis no benefit was derived, while in subacute eczema the results were bad.

Bassorin Paste in the Treatment of Skin Diseases.

Geo. T. Elliott (*Journ. of Cut. and Gen.-urin. Dis.*, May, 1892) again calls attention to the value of this new vehicle for the application of remedies in cutaneous diseases. The formula is as follows: ℞. Bassorin, 48; dextrin, 25; glycerin, 10; water, q. s. ut ft. 100. The resulting paste is a smooth, jelly-like mass, resembling petrolatum in color. It is odorless and unobjectionable. It must be kept in a closed glass jar. Various substances may be incorporated with it, which, owing to the adhesive properties of the paste, are brought in close contact with the skin. It is of more service in winter than in hot weather. It proves useful in papular acne, rosacea, seborrhœic eczema, and in the parasitic skin diseases. The absence of greasiness and stickiness, and its cleanliness, commend it in many cases, and especially in those cases where fatty substances are not well borne.

Dermatitis Hæmostatica.

Dr. H. G. Klotz (*Transactions American Dermatological Association*, New York, 1891) suggests the name dermatitis hæmostatica for the more or less chronic conditions of the leg commonly called "sore leg," occurring for the most part in elderly persons belonging to the laboring classes, the pathological state being characterized by dilatation of bloodvessels, swelling, discoloration, hemorrhage, hard infiltration, hyperplasia, atrophy, ulceration, and cicatrization. External injury does not play a part in all of such cases. The subjective symptoms are slight, though a sense of heaviness or soreness may be present. Eczema may complicate the condition.

Universal Erythema Multiforme.

Dr. L. A. Duhring (*Ibid.*) describes a case of universal erythema multiforme, the eruption being of an erythematous type with a tendency to papular and vesicular lesions in certain localities, the whole process in two or three weeks terminating in extensive exfoliation of the whole epidermis. There was itching, and the case presented features showing the process to be allied to dermatitis exfoliativa.

New Method of Skin-grafting.

Dr. Morrow (*Ibid.*) describes a new method of skin-grafting, the peculiarity consisting in the depth of the graft, which includes the entire thickness of the skin and in some cases a layer of subcutaneous tissue, and in the method of procedure, which consists in removing a button of tissue of any required depth by means of a round cutting instrument known as the Keyes cutaneous punch, and immediately inserting it in a receptacle or bed previously made by the same instrument. The method constitutes an ideal

treatment for small circumscribed malignant and papillary growths occurring on the face, such as epitheliomata, lupus nodules, moles, warts, and other facial blemishes.

Hydrargyrum Formamidatum in Syphilis.

Dr. Morrison (*Ibid.*) recommends the hypodermatic use of hydrargyrum formamidatum in syphilis, stating that in obstinate cases it can be relied upon to accomplish what no other form of treatment has done. There is no danger of abscess resulting. A one per cent. solution is used.

Sarcoma of Skin.

Dr. F. J. Shepherd (*Ibid.*) reports an unusual case of sarcoma involving the skin of the arm, which was amputated at the shoulder-joint. There was a recurrence of the growth in the stump, which was excised, and subsequently, to relieve pain, the brachial plexus cords were resected, with relief of pain. The lymphatics were early and extensively involved—an unusual course in spindle-celled sarcoma.

Multiple Sarcomata.

Dr. Sherwell (*Ibid.*) gives a paper entitled "Multiple Sarcomata," with the history of a case showing modification and amelioration of symptoms with large doses of arsenic, which remedy possessed over the disease a positively beneficial effect, causing the tumors to entirely disappear; but subsequently, upon cessation of the remedy, they recurred.

Lichen Scrofulosorum.

Dr. Griandon (*Ibid.*) reports a case in a lady, aged twenty years, of the rare disease (in this country) of lichen scrofulosorum, occurring as a number of dark-red, hard, small papules, arranged in crescents and segments of circles, resembling the small, miliary, papular syphiloderm. There were no symptoms of tuberculosis.

Treatment of Alopecia Areata.

Dr. Morrow (*Ibid.*) discusses the treatment of alopecia areata, stating his belief that the vast majority of cases of typical alopecia areata were caused by a specific germ, the microscopical characters of which and the conditions which favor its propagation being as yet unknown. The hairs around the border of the patches are closely clipped, and, if they yield readily, are to be extracted with forceps. In recent cases chrysarobin, 8 to 10 per cent., and salicylic acid, 2 to 5 per cent., are recommended, in liq. gutta-percha or lard, applied every three or four days in sufficient strength to maintain a moderate dermatitis. Equal parts of acetic acid and chloroform are also well spoken of; also, chloral 5 grammes, officinal ether 25 grammes, and acetic acid (crystal) 1 to 5 grammes, repeated two or three times a week. In the intervals a stimulating oil once a day, as oil of euca-

lyptus and oil of turpentine, each half an ounce, crude petroleum 1 ounce, alcohol 1 ounce, together with massage, are employed. Sulphur, resorcin, and salt-water frictions are also useful.

DR. BULKLEY (*Ibid.*) calls attention to a method of treatment that he has for a number of years employed satisfactorily, which consists in the thorough application of carbolic acid, 95 per cent. strength, rubbed into the patches one or more times. It is a little painful at first, but the second application is not often complained of. It should not be used on more than two or three square inches at one sitting, several days being allowed to elapse before another touching. Bulkley is not a believer in the parasitic nature of the disease.

MOLLUSCUM CONTAGIOSUM.

DR. GRAHAM (*Ibid.*) relates the history of an outbreak of this disease in the Toronto Infants' Home, the epidemic lasting three years and attacking fifteen children. The conclusions drawn were: 1. That the disease is contagious; 2. That it is conveyed by direct contagion; 3. That those who suffer extensively from molluscum contagiosum do not seem so liable to again contract the disease.

HISTOLOGY OF MOLLUSCUM CONTAGIOSUM.

DR. MACALLUM'S studies (*Ibid.*) show that the molluscum growths take their origin in the stratum mucosum of the epidermis. The "molluscum corpuscle," which plays such an important part in the pathology of the disease, should be applied only to the peculiar hyaline body inside its containing epithelial cell. These corpuscles are elements which arise *in* the epithelial cells of the lower layers of the stratum mucosum, and at first are not larger than the plasmasomata (nucleoli) of the same or neighboring cells. In some preparations the nucleoli can be seen undergoing extension from the nucleus or migrating therefrom. During the passage of the epithelial cell outward the corpuscle enlarges, and its homogeneous substance becomes transformed into a more or less coarsely granular material. The large size of the corpuscle now forces the cell nucleus to one side and flattens it, while the cell protoplasm around the corpuscle now forces the cell nucleus to one side, the cell protoplasm around the corpuscle finally becoming merely a membrane. The origin, the increase in size, and the peculiar changes which the corpuscle undergoes all indicate that it is a cellular product and not a parasite (psorosperm).

MYCOSIS FUNGOIDES.

DRS. STELWAGON and HATCH (*Ibid.*) report two cases of this disease, one a Russian woman, aged forty-three years, the other a native farmer, aged thirty-nine years. In one case there existed precursory erythematous and eczematous symptoms concomitantly with the appearance of the characteristic tumors and fungoid growths. Death ensued a year after the beginning of the disease. In the other case, precursory erythematous, eczematous, and urticarial lesions existed for a period of ten years, the smaller tumors appear-

ing eighteen months before his death. In neither case was the lymphatic system involved.

In one case an autopsy was obtained, which showed no tumor invasion of the internal organs. The cutaneous growths were made up of small, lymphoid cells reposing in a fine embryonic connective-tissue stroma. From the clinical, histological, and bacteriological studies of these two cases they may be classified as "specific granulomata," for the reasons that the process is a proliferative, eliminative one characterized by the production of tumor foci poor in blood-supply and readily undergoing cheesy degeneration. These tumor foci are made up of lymphoid cells lying in loose meshes of an embryonic connective-tissue framework; the small round cells are collected around the bloodvessels as in syphilis, and peculiar microörganisms are present in the tissues, and are capable of cultivation upon nutrient media.

Value of Epilation.

Dr. Zeisler (*Ibid.*) discusses the value of epilation as a dermato-therapeutic measure, the advantages gained by its use consisting in the removal of the several parasitic elements which may be imbedded in the hair-shaft; in the laying open of the follicles which permits of a deeper-reaching effect of the parasiticide used, and in removing a source of irritation of the surrounding tissues. The diseases for which the method is recommended are the different forms and localizations of sycosis, favus, tinea tonsurans, tinea sycosis, pustular (sycosiform) eczema, and alopecia areata.

Tumenol and its Uses in Skin Diseases.

Professor A. Neisser, of Breslau (*Deut. med. Wochenschr.*, 1891, No. 45), has made use of this remedy for the past two years, and recommends it as valuable in the therapy of eczema, especially as an antipruritic. It is obtained from mineral oil by the action of sulphuric acid, and, while similar, is different from ichthyol. In concentrated form it is black, the odor not objectionable. In tumenol two substances are present: 1. Tumenol-sulphur, always of oily consistence, and designated "tumenol oil;" and 2, tumenol-sulphate, known as "tumenol powder." The former is insoluble, the latter soluble in water. A tincture may be prepared from tumenol powder, in two forms, as the following:

℞.—Tumenol	5 parts.
Ether	15 "
Alcohol	15 "
Water [or glycerin]	15 "

That containing water dries quickly. That with glycerin may be followed by some dusting-powder with advantage. For salves, pastes, and plasters the tumenol oil is to be preferred. The remedy has been found useful in moist, subacute eczema, and in burns of the first and second grades. It affects chiefly the superficial cutaneous strata. It allays itching not only in eczema, but also in the parasitic inflammations, and in prurigo and in pruritus—in the latter diseases, especially in the form of the tincture. In eczema with fissures, as about the anus and scrotum, it proves valuable.

It is also useful in superficial and deep ulcerations, and in leg ulcers. It is not a parasiticide. Upon the general organism it does not seem to exert any injurious effect.

An Epidemic Skin Disease.

Thomas Savill (*British Medical Journal*, December 5, 1891), Medical Superintendent of the Paddington Infirmary, reports an unknown form of cutaneous disease occurring epidemically in that institution, 163 out of 846 inmates (nearly 20 per cent.) being affected during a period of five months. Only one case was brought into the infirmary with the disease. As a cause of the eruption, food, soap, water, and scabies were excluded. The notes of four typical cases (with one colored portrait and photographs) are given. The eruption is in its essence a dermatitis of more or less general distribution, which commences usually with discrete papules, which sometimes go on to the formation of vesicles, and always results in very extensive desquamation or exfoliation of epidermis. It is attended by a certain amount of constitutional disturbance, and runs a more or less definite course of about seven weeks. Sometimes maculæ, resembling German measles, which become confluent, forming a uniformly thickened, crimson skin, with the characteristic scales in flakes, occurred; but the usual form was papulo-erythematous. A dry and a moist type were noted, the latter bearing some resemblance to eczema, but with more thickening of the skin, and with profuse serous exudation. The disease was liable to relapse, or, more strictly speaking, to recrudesce, 38 out of the 163 cases being so affected. The hair and nails were generally shed. The two most constant constitutional symptoms were anorexia and prostration. The temperature tended to be subnormal except when the inflammation was at its height. The mortality was 12 per cent., and was chiefly among males, and those advanced in years. Children were almost exempt. In the early stages, antiseptics, such as creolin, seemed to have a marked controlling influence, but in the later stages these were powerless. The essential predisposing conditions for its occurrence seemed to be advancing years and debility from sickness, "hospitalism," or other cause. The disease bore some resemblance to pityriasis rubra.

Etiology of Itching.

Dr. E. B. Bronson, of New York (*Medical Record*, October 24, 1891), takes the ground, in an admirable and exhaustive article, that pruritus, like neuralgia, tinnitus or photophobia, is only a sensation, and, therefore, only a symptom. It is the sensory manifestation of some morbid change unaccompanied by visible alterations. It is a nervous derangement involving some molecular change that disturbs normal relations. A factor of importance in the production of excessive itching, nearly always present, is a state of cutaneous hyperæsthesia. This is a peculiar morbid state in which all the senses are coördinately exaggerated. It is an abnormal condition unfavorable to the highest functional activity of any organ. The causes of itching may be divided into—1, predisposing, and 2, exciting. In the first class, itching may occur as the local expression of a general neurotic condition, which may be either congenital or acquired. It may also be due to local changes in the

skin, attended with prolonged irritation of the cutaneous sensory nerves; or it may be caused by a state of impaired conduction in the cutaneous nerves of tactile sense. Though usually occurring with hyperæsthesia of the skin, it may exist independently of the latter, as in pruritus senilis. The exciting causes are either irritations conveyed to the skin from the interior of the body, as reflex irritations or irritations transmitted from nervous centres; or direct or local irritants, from extraneous sources, or originating within the skin, as in the case of trophic skin diseases. To the latter class also belong those cases where itching is due to toxic or noxious substances deposited from the blood. It may also arise from local nutritive disturbances or deranged metabolism in the cutaneous sensory nerves.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

J. SOLIS-COHEN, M.D.,

OF PHILADELPHIA.

Thyroiditis.

M. Gerard-Marchand, of Paris, has observed (*Rev. de Lar.*, etc., 1 Mai, 1891) an instance of spontaneous thyroiditis in a hypertrophied gland, in which bacteriological examination of the pus revealed the presence of pneumococci.

Thyroidectomy.

M. A. Reverdin, of Genoa (*Ibid.*), reports a series of 14 operations: 10 in females, 4 in males. The average sojourn in the hospital was eight days. One patient succumbed—the only one he ever lost. In this subject the trachea was in a state of great softening. Reverdin operates by a large incision along the anterior border of the sterno-mastoid muscle, with lateral extensions, if requisite. The muscles are divided and sutured after the extirpation. Superficial vessels are gently secured between pincettes and then divided. Either enucleation or partial extirpation is practised according to the conditions present. Total extirpation is no longer practised.

Thyreotomy in an Infant, Eighteen Months Old.

Dr. Clinton Wagner reports (*N. Y. Med. Journal*, 1891, No. 675) a successful case with removal of a papilloma, the size of a small pea, from the posterior portion of the left vocal band. Tracheotomy had been performed two weeks earlier for laryngeal dyspnœa, which became immediately relieved. Circumstances unconnected with the clinical history of the case

prevented the proposed removal of the canula, but the patient breathed comfortably through the larynx with the orifice of the tube plugged, and his voice was returning, when he died from an attack of influenza eleven months after the operation.

Hysterical Aphonia Cured by Compression of the Ovaries.

Dr. Higguet, of Bruxelles, reports (*Rev. de Lar., etc.*, 1891, No. 18) a case of hysterical aphonia cured in about three minutes by slow and progressive compression of the ovaries as recommended by Jonquiere (*Monats. f. Ohren.*, June 6, 1890), after several weeks of failure with constitutional treatment, electricity, and cold douches. Slight recurrences have taken place at the menstrual periods and under emotional excitement, but they have subsided in a few days without treatment.

Higguet attributes the aphonia to paralysis of the group of inter-arytenoid muscles, and he believes that compression of the ovaries causes spasm of these muscles, and thus overcomes both the paralysis and the aphonia. He states that traction on the ovaries in abdominal surgery frequently produces spasm of the larynx.

Adenoid Vegetations of the Rhino-pharynx.

Dr. Delie, of Ypres, relates (*Revue de Laryngologie*, No. 18, 1891) the clinical history of a lad thirteen years of age, from whom he removed some adenoid vegetations with complete relief from all the disagreeable symptoms. Some two months later nasal obstruction gradually recurred, with spontaneous epistaxis gradually increasing in amount and in frequency. Large tumors were found in both choanæ, one of which filled the posterior third of one of the nasal cavities. Another tumor occupied the entire rhino-pharynx. These neoplasms bled freely on the contact of the exploratory stylet. Histological examination of fragments removed for that purpose, revealed nothing more than hypertrophied adenoid tissue, although sarcoma was suspected. These growths were removed by electro-caustic procedure, and the cavities were well scraped. A second recurrence was thoroughly eradicated. Again recurrence with rapid growth, and with submaxillary enlargements. Then electrolytic treatment. Histological examination revealed globocellular sarcoma. Finally terrific cephalalgia, vertigo, and sudden death.

The author regards the sarcomatous recrudescences as evidences of transformation, and intimates that diagnosis based upon microscopic examinations should not always supplant that based upon clinical features.

Methods of Using Trichloracetic Acid in the Nose and Throat.

Dr. Gustav Killian, of Freiburg, recommends (*Münchener med. Woch.*, No. 39, 1891) its use in concentrated solution or in the deliquesced condition in preference to the crystals, which are difficult to manage, A few crystals can be well shaken up with two or three drops of water. In this condition it is nearly as effective as when solid. It can be applied with a cotton wad firmly rolled around a probe or held in one side of a pair of forceps, so that

the metal only can come in contact with the sound tissues on the opposite side. A minute quantity suffices to paint over an entire turbinate body. Two such applications should be made in immediate sequence, and even more upon points of great swelling. The pain from the application is not so readily prevented by cocainization as electric cauterization is, and three or four applications of a twenty per cent. solution of cocaine are required.

The mucous membrane is rendered snow-white by the cauterization; and the eschar can hardly be distinguished from the eschar after electric cauterization, and it is cast off rather sooner. The parts heal without pain and without reaction, and the effects are as good as after burning. In the pharynx the pure acid has about the same effect as the silver nitrate stick.

Chronic Diphtheria of the Nose.

Dr. Luigi Concetti, of Rome, reports (*Rev. de Lar., etc.*, No. 20, 1891) a second instance of two months' duration without fever or other constitutional symptoms. Cultures produced numerous colonies of the bacillus described by Löffler. Dr. Concetti warns against considering such cases of chronic diphtheria as innocuous, and urges all the curative and prophylactic precautions employed in acute diphtheria. In the instance reported in 1886, the infant infected three other children and a servant in the same family, and the case was followed by paralysis of the pharyngo-laryngeal muscles.

Suppuration of the Maxillary Sinus.

Dr. Franz Bloch, of Heidelberg, reports (*Münchener med. Wochenschr.*, No. 34, 1891) some cases illustrating the operative procedures employed in the clinic of Professor Jurasz. The antrum is entered from the inferior nasal meatus with lance-pointed trocar, and irrigation is made through a double catheter-beaked canula, so as to provide for flushing the sinus by reflux in case the normal opening in the middle nasal meatus should be clogged. When the normal opening is accessible, that orifice may be utilized for the insertion of the canula.

Nasal Tuberculosis.

Dr. A. Cartaz presents an instructive paper based upon the study of eighty cases from various observers. Seven cases were under his own care (*Gaz. hebdom.*, No. 18, 1891). Primitive tuberculosis of the nasal passages is rare, the large majority of instances occurring in the subjects of more or less advanced pulmonary tuberculosis. Direct inoculation is viewed as the main etiological factor, possibly by the contact of portions of sputa expelled by cough, certainly in a few instances by the use of pocket-handkerchiefs into which the patient has expectorated. Two forms of manifestation prevail, ulceration and the formation of a tumor. Miliary granulation is said not to have been observed, probably because its presence does not give rise to symptoms driving the patient to a physician. Nevertheless, it is probably the first step in the process. The ulceration, often unique, usually occupies the septum or the furrow between the septum and the floor of the passage. Sometimes it occupies the turbinate bodies, sometimes the posterior extremity

of the middle and lower turbinates. Its extent varies from the size of a ten-cent piece to that of a twenty-five-cent piece, its form being more or less rounded and oval. The floor is usually pale grayish-red, and is covered with some viscous muco-pus or with thin crusts. Caseous masses are fixed on some anfractuosities of the ulcer, while fine grayish granulations at other points represent miliary tubercles not yet softened. The borders are sometimes raised and sometimes irregularly dentated. Yellow tuberculous points are sometimes seen at the periphery or immediately adjacent, representing the early phase of subsequent similar ulceration. In some cases tuberculosis of the pharynx, soft palate, or the tongue occurs at the same time. Pain is rarely severe. In the second form, the tumor is usually developed at the anterior portion of the septum. It is usually sessile or has a large pedicle. It may vary from a minute size to a bulk sufficient to occlude the passage. It is pale red and often bosselated. In some instances it is soft, in others hard. Its surface may present perforations through which the probe penetrates into a fungous, caseous tissue, a veritable cold abscess in process of regression. The tumor may be bilateral, and two such tumors may communicate, but the septum does not undergo perforation.

In both varieties the course is slow. Primitive cases may be thoroughly cured, and pulmonary tuberculosis follow without any recurrence at the original seat of lesion. Extension is progressive and continuous unless arrested by treatment, but does not acquire the acuity noted in the pharynx, the larynx, and the lung.

The treatment consists in thorough curetting, preceded by ablation of any tumors, and cauterization with the electric cautery, lactic acid, chromic acid, zinc chloride, or some other agent. These operations should be completed at one sitting when practicable. Cocainization should precede and tamponing follow. Cotton-wad impregnated with vaselin surcharged with antipyrine and with salol is recommended as an antiseptic and a perfect hæmostatic.

As a matter of course, antiseptic washes should precede and follow the surgical intervention, and appropriate hygienic and medicinal treatment be instituted.

Deviations of the Septum Narium.

A case of deviation spontaneously corrected by a traumatism is reported by Dr. Potiquet (*Rev. de Lar., etc.*, 15 Avril, 1891).

The condition was discovered post-mortem. The fracture had taken place from above downward, and one of the broken ends of the septum was found superposed on the other, correcting the deformity which must have exisied before the accident.

Impairment of Voice due to Mucous Hypertrophies of the Posterior Segment of the Nasal Septum.

Dr. Raulin, of Marseilles, reports (*Rev. de Lar., etc.*, 1891, No. 10) impairment of voice in a singer and in a clergyman due to thickenings of the soft tissues on both sides of the posterior portion of the vomer, and completely relieved by electro-caustic destruction of the hypertrophied masses.

[Similar instances have not been infrequent in the experience of the compiler. The trouble is physical and not reflex. The resonance is impaired and can no longer accord with the higher tones of the register.—ED.]

TUMORS OF THE TONSIL.

M. LEFOUR reports (*Journ. de Méd. de Bordeaux*, 1891, No. 38) a case of fibrous polyp developed during pregnancy, and refers to two instances in which he saw epulis developed in the mouth under the influence of pregnancy, and also to an observation by Professor Coyne of the development of a vascular tumor of the interior of the lower lip developed under similar conditions. M. Arnozan has likewise observed an instance of epulis in two situations under similar conditions with retrocession and disappearance after delivery.

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.,

PROFESSOR OF OBSTETRICS AND DISEASES OF INFANCY IN THE PHILADELPHIA POLYCLINIC; CLINICAL LECTURER ON OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE; VISITING OBSTETRICIAN TO THE PHILADELPHIA HOSPITAL, ETC.

THE STUDY OF UMBILICAL INFECTION IN ONE THOUSAND INFANTS.

In the *Archiv für Gynäkologie*, Band xli., Heft 3, ERÖSS publishes his results from the study of umbilical infection in 1000 infants. Careful measurements of temperature in these cases showed a large number of febrile patients, in most of whom no disease was evident. In only 32 per cent. were normal and undisturbed drying and cicatrization of the cord and umbilicus observed. In 14.7 per cent. inflammation of the connective tissue about the umbilicus was present.

After comparing various methods of treating the cord, it was found best to leave it not longer than three-fourths of an inch, to ligate with linen tape which had been thoroughly impregnated with bichloride of mercury, and to envelop the stump in a dry dressing, of a piece of clean, dry linen cloth. It was also found useful to cleanse the tissue about the umbilicus with 1 : 1000 bichloride, envelop the cord in sterile cotton, and cover the dressing with sheet rubber, to protect it from contamination. It is better not to bathe an infant by dipping it into water until after the umbilicus is healed.

Although gangrene of the umbilicus rarely occurred, yet septic infection through this channel, with subsequent complications, was not infrequent. The mortality from this source in two large clinics is stated at 25 and 30 per cent. Of these, 70 per cent. showed no symptoms of external inflammation, while 50 per cent. presented inflammation of the umbilical vessels.

In preventing umbilical sepsis the greatest importance is laid upon a rapid and complete drying of the stump of the cord. Next in value is thorough cleanliness. In hospitals, those nurses who attend lying-in women should not care for their infants; all obstetric nurses should pay especial regard to the antisepsis and cleanliness of the umbilical region of the newborn. It is curious to observe that the mothers of these infants showed no signs of puerperal sepsis.

A Contribution to the Study of Puerperal Eclampsia.

Goldberg, of Dresden, in the *Archiv für Gynäkologie*, Band xli., Heft 3, and Band xli., Heft 1, draws interesting conclusions from 81 cases of eclampsia. Although more frequent in primigravidæ, the mortality is much greater in those who have borne children. Eclampsia beginning in pregnancy is most fatal; least so when it commences in the puerperal state. Profound disturbance of the nervous system is a more unfavorable symptom than the albuminuria, dyspnœa, cyanosis, and bad pulse. The most successful treatment is speedy delivery. The forceps is especially successful for mother and child. Version and extraction were also successful. Craniotomy was less valuable as a means of treatment. Cæsarean section was followed by septic peritonitis and death. Induction of labor was successful, as was also incision of a rigid os and extraction. Hot baths and packs, chloroform, chloral, and morphine were reliable agents. Large doses of morphine should be avoided, as collapse sometimes follows their use.

The Condition of the Kidneys in Eclampsia.

In the *Zeitschrift für Geburtshülfe und Gynäkologie*, Band xxiii., Heft 1, Prutz describes in detail the condition of the kidneys in 22 cases of fatal eclampsia. While acute and chronic processes were present in many, in many others there was no pathological condition in the kidneys sufficient to account for the eclampsia. In many cases congestion and transudation of serum seemed the condition present. Microörganisms were absent. There was no relationship between the severity of the eclampsia and the extension and severity of the pathological lesions in the kidneys: many of the severest cases of eclampsia showed but slight alterations in the kidneys.

In the kidneys of infants born during eclampsia were found an absence of inflammation; epithelia intact; a great number of hyaline casts and enormously distended veins; infarcts of uric acid were also present. The lesions seemed to be those of intense congestion and transudation of serum.

The Bacteriology of Eclampsia.

Gerdes (*Münchener med. Wochenschr.*, No. 22, 1892) describes the bacteriological examination of an interesting case of eclampsia in which extensive lesions of the kidneys and liver were present. He cannot account for the condition except as the result of an infective process, some of whose germs he isolated and describes. Further light can be shed upon the causation of eclampsia by the study of infective processes and the relation of bacteria to them.

The Condition of the Liver in Eclampsia.

Pilliet and Delansorme report (*Bulletins de la Société Anatomique de Paris*, No. 8, 1892) an interesting case of eclampsia in which the liver showed complex alterations in connective tissue, vessels, and parenchyma. The lesion was hemorrhagic hepatitis, with extensive parenchymatous necrosis.

The Diagnosis of the Kidney of Pregnancy and Nephritis in the Pregnant Woman.

In the *Prager med. Wochenschrift*, No. 17, 1892, Fischer finds that the urine from the kidney of pregnancy contains formed elements in moderate amount during the last four or five weeks of pregnancy, rapidly disappearing after labor. Leucocytes; $\frac{3}{100}$ of 1 per cent. of albumin; hyaline and a very few granular casts, and red blood-corpuscles, are not a ground for changing the diagnosis. Red blood-corpuscles in considerable amount, occurring early in pregnancy and suddenly increasing, indicate acute nephritis. Granular and epithelial casts indicate chronic nephritis; hyaline casts alone are of little moment.

Seventy cases were examined; in 58 the kidney of pregnancy was found during the second half of pregnancy. Nephritis of pregnancy was diagnosticated in 8.

Sudden Death during the Puerperal State.

Ehrendorfer (*Wiener medizinische Presse*, 1892, Nos. 20 and 21) calls attention to fatty degeneration of the heart muscle as a not infrequent complication of pregnancy, and describes a case of sudden death in a puerpera from thrombosis of a cerebral sinus occurring in connection with fatty heart. The patient was a young primipara whose labor was normal. On the tenth day after labor she left her bed, and on the eleventh day she was suddenly seized with syncope, headache, and sensations of cold. She afterward vomited, had unequal pupils, convulsions, paralysis, contractures, and symptoms of profound depression in the central nervous system. A moderate rise in temperature occurred also. Death ensued seventeen hours after the first attack of unconsciousness. The post-mortem revealed an entire absence of septic infection and inflammation; no abnormality was discovered in the pelvic organs. Simple thrombosis of the falciform sinus and veins of the dura and pia mater, with subdural and inter-meningeal hemorrhage, was present.

A second case of fatty heart and sudden death is also reported in a young primipara who was delivered of twins with forceps. Although delivery was not difficult, she collapsed an hour afterward and died. The placenta was adherent and required manual removal. Fatty degeneration of the heart, with the general lesions which accompany it, was found at the autopsy.

But little can be done to prevent death in these cases. The patient should be spared all possible strain during pregnancy and given appropriate tonics. Labor should be expedited so far as possible. Camphor and musk may be used by injection. Anæsthetics may be cautiously employed to advantage, combined with manual delivery. To prevent the sudden fall in intra-abdom-

inal pressure a bag of sand weighing several pounds may be placed upon the abdomen after delivery. Some of the cases, not explicable by post-mortem lesions, are probably caused by reflexes from lesions or injuries of the nervous supply of the genital organs.

What Constitutes Essential Obstetric Antisepsis?

Veit replies to this question in the *Berliner klinische Wochenschrift*, Nos. 20 and 21, 1892, as follows: As prophylaxis, doctor and nurse should wear clean clothing; the patient should have a bath when possible; the external parts should be invariably cleansed with soap and water by a clean hand. The hands of the obstetrician or midwife, and the patient's external parts, should be disinfected before each internal examination or operation, and also just before the exit of the child. Disinfection of the internal parts is never necessary under normal conditions. Disinfection, either external or internal, is unnecessary after normal labor. Internal examination should be as infrequent as possible, and should be made by sight, the finger never being passed over the perineum into the vagina.

An occlusion napkin or dressing does not maintain an aseptic condition, but absorbs the secretion and thus furnishes a means of diagnosis. Sterile gauze should be always available, but is rarely needed.

In the Dresden Obstetrical Clinic, Leopold and Goldberg (*Deutsche medicinische Wochenschrift*, No. 13, 1892) have omitted all vaginal injections for several years. The result has been a marked decrease in morbidity and mortality, from sepsis and other causes. They, therefore, rely as much as possible on external examinations only, with careful external antisepsis, omitting all injections in normal cases.

Complete Instrumental Abortion for Pregnancy Complicated with Aortic Disease.

Dolléris (*Nouvelles Archives d'Obstétrique et de Gynécologie*, 1892, No. 5) reports the case of a primigravida, suffering from aortic insufficiency, in whom a fatal prognosis had been given should pregnancy occur. Her condition was one of extreme prostration, with vomiting and threatened collapse. After careful preparation by bichloride douches and tampons of iodoform gauze, two days were spent in gradual dilatation of the uterus with laminaria tents. Under opium, but without an anæsthetic, the uterus was gently but thoroughly curetted with a sharp curette and the entire ovum removed. An intra-uterine douche was given and a tampon of gauze was applied. Uninterrupted recovery followed, menstruation recurring three weeks after the operation.

The Treatment of Circumscribed Tubal Pregnancy.

Gusserow (*Berliner klinische Wochenschrift*, 1892, No. 22) reports 13 cases of tubal pregnancy in which sudden rupture and hemorrhage occurred, with great danger to life. In 10 there was no apparent cause for rupture; in 1 case it followed curetting the uterus; in 1 a difficult defecation, and in 1 an

examination. The discharge of decidua was not present as a diagnostic sign; in 8 cases a fœtus could be found; in 5 the microscope detected villi of the chorion. Although these patients were in collapse when operated upon, 11 recovered; 1 died thirty days after operation from an old kidney lesion, the other perished in collapse.

He also reports seven cases of tubal pregnancy with retro-uterine hæmatocele which were under observation for some time before rupture and in which the patients' condition was never threatening so long as they remained quietly in bed. Six of these patients recovered after operation, one died of acute anæmia.

From these cases Gusserow concludes that laparotomy should be invariably performed as promptly as possible whenever symptoms of intra-abdominal or pelvic hemorrhage appear. Patients should be taken to surgical hospitals whenever possible. Where retro-uterine hæmatocele is present the patient may be kept under observation, if she remains quietly in bed. Cases of normal pregnancy, with small tumors near the uterus, do not call for laparotomy, and a positive diagnosis can only be made by keeping such a patient under observation. It is important to ascertain whether the ectopic fœtus is living or not, in the same manner.

GYNECOLOGY.

UNDER THE CHARGE OF

HENRY C. COE, M.D., M.R.C.S.,
OF NEW YORK.

The Origin of the Graafian Follicle.

Schottlander (*Prager med. Wochenschrift*, Nos. 2 and 3, 1892), arrives at the following conclusions as the result of his microscopical studies: Ova and follicular epithelium are both formed directly from the germ-epithelium. Waldeyer's ova-spheres are next formed. From these are developed, through ingrowth of the connective tissue, the following:

1. Pfluger's follicles, the true significance of which is not clear. 2. The typical primordial follicles. 3. Atypical primordial follicles, or those which arise secondarily, from which ova-cells are separated by ingrowths of connective tissue. 4. Follicles which are formed in the same way from the ova-spheres. Nagel's cells are ova-cells which are derived from the spheres and may be regarded as accessory ova; they soon degenerate. 5. Follicles which are formed by the separation of larger or smaller portions of Pfluger's pouches.

In the two latter ways ripe Graafian follicles are formed more rapidly than by the gradual growth of primordial follicles. These processes are not

repeated in the adult. Rarely collections of germ-epithelium, without ova, are found from which may develop cysts lined with epithelium.

The Graafian follicle becomes the seat of various retrograde changes. Atrophy is a physiological process in mammals. The nucleus undergoes simple atrophy or pigmentary degeneration; and an ingrowth of connective tissue from the *theca interna* leads to the formation of a cicatrix. When cicatrization is imperfect, as may occur in large follicles, epithelial cysts may result. The corpus luteum undergoes fatty degeneration, an overgrowth of fibrous tissue takes place, which may later contract. Later the corpus luteum becomes absorbed, and the connective tissue may be the seat of hyaline degeneration, which latter is also observed in the cicatrices of atrophied follicles.

Sarcoma of the Urethra.

Ehrendorfer (*Centralblatt für Gynäkologie*, 1892, No. 17) describes and illustrates a case of round-celled sarcoma of the urethra which is almost unique, as Winckel mentions only one other case, of Beigel's. It is to be distinguished from the condition described by Thiem as "peri-urethral sarcoma." In Beigel's case the patient was a multipara, aged fifty, and the growth was of five years' standing, the initial symptoms being pain and hemorrhage after coitus, but no pain during micturition. In Ehrendorfer's case the patient was a multipara, aged fifty-two, who had passed the menopause eight years before. During the past year and a half an enlargement had gradually developed at the meatus urinarius, not attended with urinary symptoms. More recently a reddish, watery discharge had appeared, without odor. On examination several large fleshy folds or projections were seen protruding from the meatus. These were readily excised.

Operation for Accessory Ureter.

Baum (*Archiv für Gynäkologie*, Band xli., Heft 2), reports the case of a young girl, in whom the right ureter was double, one branch passing beneath the base of the bladder and opening at the side of the urethra, so that the patient was troubled with constant dribbling of urine. An incision was made above the symphysis, as in epicystotomy, and an opening was made in the floor of the bladder at a point where it was crossed by the aberrant ureter. The latter was then divided, the distal portion was ligated, and the proximal end was stitched into the incision in the bladder, the result being entirely satisfactory. This method of operating was adopted because the patient was a virgin; under suitable conditions it might be performed *per vaginam*.

Development of the Urethra and Perineum in the Human Female.

Nagel (*Centralblatt für Gynäkologie*, 1892, No. 17), as the result of his studies of embryos, has found that the cloaca, into which empty originally the gut and the canalis urogenitalis, is alike in both sexes, as are the first steps in the development of the urethra—indicated by the formation of the glans and the portion of the canal immediately adjacent to it. Later, the glans in the female retrogrades, and the epithelial furrow

at its side remains open, but later disappears entirely. The urethra is formed by the coalescence of the lateral walls of the cloaca. In the female the canalis urogenitalis disappears, a portion remaining corresponding to that part of the male urethra between the bladder and the ejaculatory duct. The external separation of the cloaca occurs by the union of its lateral walls posteriorly, through hypertrophy of the epithelium covering corresponding opposing surfaces.

Treatment of Pyosalpinx by Aspiration and Irrigation.

Nitot (*Bull. et Mém. de la Soc. Obstet. et Gynécol. de Paris*, No. 7, 1892) calls attention to the fact that in many cases of pelvic suppuration it is not always possible to remove a diseased tube, so that the abscess must be packed and drained through the abdominal wound, with considerable danger to the patient. Vaginal hysterectomy performed for the same condition is generally regarded as too heroic an operation. Conservative surgeons recommend opening the abdomen and withdrawing the contents of a pyosalpinx without extirpating the tube. It seems more rational to do this by puncture *per vaginam*. The writer uses a large-sized needle and washes out the tube with a solution of bichloride after withdrawing its contents. With strict antiseptic precautions there is a minimum amount of risk, and laparotomy can be performed subsequently if desired.

Micrococci in the Pus of Pyosalpinx.

Witte (*Centralblatt für Gynäkologie*, No. 23, 1892), referring to the fact that Wertheim in a large number of observations failed to find any bacteria in the pus from diseased tubes except gonococci, describes a case which seemed to prove the possibility of mixed infection. In a young woman with gonorrhœal vaginitis he found in the vagina both gonococci and streptococci, a fact which explains the septic infection sometimes noted in puerperal women with gonorrhœa.

Abdominal and Pelvic Emergencies Causing Death.

Irish and Stone, in an interesting medico-legal paper on this subject (*Boston Medical and Surgical Journal*, 1892, No. 25), refer to a number of cases of sudden death from non-traumatic abdominal and pelvic lesions. Among the causes mentioned are perforation of the bowel in ambulatory typhoid cases, and ruptured ectopic gestation—emphasis being laid upon the relative frequency of the latter condition.

The Results of Gonorrhœal Infection in Women.

Rosthorn (*Prager med. Wochenschrift*, 1892, Nos. 2, 3) reviews the course of gonorrhœa in the female, which is favorable so long as it is confined to the vagina. When the infection has spread to the cervical canal it assumes a chronic form ("ascending" gonorrhœa), and is situated in the endometrium and tubal mucosa. Even when the patient is cured there remain the catarrh and adhesions, which give rise to menstrual disturbances. The influence of gonorrhœa upon pregnancy and the puerperium is more serious than stated

by Sänger. In the acute stage the writer recommends applications of iodoform and tannin, with injections of one per cent. solution of bichloride (the vagina being immediately dried). Cauterization of the cervical canal with fuming nitric acid may be of benefit, but intra-uterine applications are inadvisable. Sänger's prophylactic measures are highly commended.

Discission of the Cervix.

Kleinwächter (*Wiener med. Presse*, 1892, No. 23) reviews the influence of Sims's teaching upon German gynecology, especially with reference to the treatment of sterility, and refers to the fact that discission was formerly regarded as a sovereign cure for sterility. It has taken a long time for gynecologists to grasp the fact that a woman may be childless without being sterile. Sterility is only present when a woman cannot conceive in consequence of some congenital or acquired obstruction, while childlessness may be due to some defect in the husband. Unfortunately, a want of consideration of this point has made gynecologists prone to find the female alone at fault, and this has made them induce many women to believe that discission was a sure step to pregnancy. The author reports at length thirty cases examined by him in which the operation had been done in former years without result, and shows in every instance that the operation was performed blindly and without an attempt to discover the true cause of childlessness.

[The history (if it could be written) of this operation would furnish a chapter of accidents which would serve to render it still more rare than it is now.—H. C. C.]

Epithelioma of the Cervix Uteri without Symptoms.

Siegheim (*Deutsche med. Wochenschrift*, 1892, No. 24) reports the case of a woman fifty-nine years of age, who had passed the menopause ten years before. In making a rectal examination to determine the cause of obstinate constipation, Roye found advanced carcinoma of the cervix with involvement of the perimetric tissues. The patient had not had any pelvic symptoms whatever, although the condition was evidently of long standing. The writer adds, that while the initial symptoms of uterine cancer are so obscure that the profession should be taught to make a local examination in every case in which a woman has slight hemorrhage, discharge, or pelvic pain, in the absence of symptoms it is, of course, impossible to recognize such a case as the one cited. Winter reports the case of a patient in whom epithelioma of the cervix was discovered by accident, and a radical operation was performed successfully; this fact led him to advise that all women should be examined periodically, which would, of course, be impracticable. At any rate, it is highly important that the general practitioner should, by overcoming his own dislike of gynecological manipulations, educate his patients to report the first symptoms of cancer, and submit to an examination.

Curetting in the Treatment of Uterine Fibroids.

Pichevin (*La Médecine Moderne*, 1892, No. 23) pleads for the more frequent use of the curette in the palliative treatment of this condition, from the well-

recognized fact that the hemorrhage in these cases is due to hypertrophy of the endometrium. Successful cases are reported.

Hysterectomy for Fibroid and Fibro-cystic Tumors of the Uterus.

Péan (*L'Abeille Médicale*, 1892, No. 28) describes the method that he now adopts, which is briefly as follows: After opening the abdomen and drawing out the tumor with a hook, its pedicle is encircled with a rubber cord, and the mass is excised above it. If there are several lobes, each is constricted with a separate cord and removed. If the bladder and rectum are adherent, they are dissected off. An écraseur-wire is then applied below the cord and the stump is trimmed down still further. The cervix is then removed *per vaginam* in pieces (*morcellement*), the broad ligaments being secured with forceps, as in vaginal hysterectomy.

Congenital Absence of the Kidney and Ureter.

Noel (*Bull. de Société Anatomique de Paris*, May, 1892) reports the case of a woman, aged sixty-two years, who died of pulmonary trouble. At the autopsy the left kidney was found in its normal position, slightly hypertrophied and cystic, the ureter being normal. The right supra-renal capsule was found, but the corresponding kidney and ureter were absent, nor was there any trace of the right renal artery and vein. The bladder had only one ureteric opening; its capacity was four ounces. The case was a rare one, since the ordinary condition is fusion of the two kidneys with double ureter.

[The importance of this condition was demonstrated in a fatal case reported by Dr. Polk, in which the single kidney had been removed for disease.—H. C. C.]

The Closure of Vesico-vaginal Fistulæ from the Side of the Bladder.

Trendelenburg (*Deutsche med. Wochenschrift*, 1892, No. 23) reports two cases of extensive vesico-vaginal fistula operated on by this method, which is reserved for fistulæ which are inaccessible *per vaginam*.

In the first case, the patient being placed in Trendelenburg's posture, a transverse incision four inches long was made just above the symphysis, the bladder was exposed, and a transverse opening was made in it just below the reflexion of the peritoneum, which was extended to the left. The upper edge of the vesical wound was temporarily stitched to the corresponding edge of the abdominal wound, and the lateral edges of the vesical incision were held apart with sutures. The fistula was situated between the ureteric openings, somewhat to the left of the median line. The urethra and both ureters were catheterized. The edges were freshened as widely as possible, and four silk sutures were inserted transversely in such a way that they could be tied on the vaginal side. A T-shaped drainage-tube was introduced through the vesical wound, which was closed around it by a double row of catgut sutures (Lembert). The pre-vesical space was tamponed with iodoform gauze and the

external wound was closed, a space being left for the tube and gauze. The drainage-tube and vaginal sutures were removed on the tenth day, when some urine escaped through the external wound and some *per urethram*. A month after the operation the wound was entirely closed, and the patient could hold her urine for three hours. Six months later the patient was examined and was found to be perfectly well.

The second case was a particularly complicated one, since the uterus was fixed by exudation, and the vagina was much contracted by cicatricial tissue, the fistula being situated high up in the funnel-shaped vaginal vault, so that it was entirely inaccessible. A transverse incision was made as before, being extended to six inches, as the patient was quite fat. In order to gain more room the upper portion of the symphysis was resected, according to Bramann's suggestion. The bladder was exposed and a transverse incision was made in its anterior wall which extended entirely across it; this was carried still further to the right and upward. The ureteric openings were located and catheterized, and it was found that a uretero-vaginal fistula existed on the right side. The right ureter was then dissected away from the bladder to the distance of a third of an inch, the ureter being shortened to that extent. The edges of the vesical fistula were denuded and it was closed longitudinally by five catgut sutures, which were tied within the bladder. In order to maintain patency of the right ureter a fine whalebone bougie was passed into it through the urethra. The bladder was drained and the wound closed as before, and, lastly, the fragment of bone was replaced and sutured with silver wire. The operation lasted five hours, both chloroform and ether being used. The patient had no bad symptoms except a temporary elevation of temperature on the second day. The drainage-tube was removed on the ninth day, and a catheter was introduced *per urethram*, which was left *in situ* for two weeks, the bougie being removed from the ureter on the fourteenth day. Four weeks after the operation the patient was able to retain four ounces of urine and to pass it spontaneously, but the abdominal fistula was still open. The detached fragment of bone necrosed, retarding the healing of the wound for seven weeks, when the patient was discharged cured.

Gonorrhœal Salpingitis.

Charrier (*Gazette Médicale de Paris*, 1892, No. 24) believes that at least 70 per cent. of the diseases of the adnexa are of gonorrhœal origin. The profession in general do not appreciate the fact that abortion soon after marriage, and sterility, are mainly due to this cause. If the importance of promptly treating specific vaginitis was recognized, many of its more serious consequences might be averted. The slight cases are more to be dreaded, since the vaginitis is not sufficiently severe to cause the patient to consult a physician before the inflammation has extended to the adnexa. It is highly important to make an early diagnosis. By prompt curettement of the uterine cavity in gonorrhœal endometritis, more good can be done than by any other treatment, since a focus of infection is eliminated and the spreading of the inflammation is prevented, with all its serious results—salpingitis, oöphoritis, and pelvic peritonitis.

PÆDIATRICS.

UNDER THE CHARGE OF

LOUIS STARR, M.D.,

OF PHILADELPHIA;

ASSISTED BY

THOMPSON S. WESTCOTT, M.D.,

OF PHILADELPHIA.

THE EXCISION OF STRUMOUS CICATRICES OF THE NECK.

In a paper read before the French Congress of Surgery (*Le Progrès Médical*, 1892, No. 18, p. 347), CALOT reports signal success in removing the unsightly and often pigmented cicatrices resulting from the spontaneous opening of suppurating lymphatic glands of the neck. With a bistoury he removes the entire extent of altered skin, encroaching one or two millimetres upon the normal integument. The edges of the wound are then freed from the underlying tissue and brought together with fine sutures, so as to make a linear closure of the exposed surface, no drainage being required. The result in all of thirteen cases thus treated has been eminently satisfactory, showing only a fine linear scar in place of the former ugly, irregular cicatrix.

A BACILLUS IN THE BLOOD IN MEASLES.

CANON and PIELICKE (*Berliner klinische Wochenschrift*, 1892, No. 16, p. 377) present some interesting bacteriological investigations of the blood of rubeolous patients. Hitherto little has been done in this direction, most observers contenting themselves with examinations of the lungs of such patients as, during life, had presented pulmonary complications. In this way micrococci have been observed disposed in masses or in little chains. Thaon found numerous micrococci and some bacilli in the lungs. Babes also observed in the lungs, lymph glands, the nasal mucous membrane, and the conjunctival secretion, microcrocci isolated or grouped in figures-of-8, or sometimes disposed in chains. In several instances the same cocci were found in blood taken from the level of the papules; but only once did this observer find a bacillus, which in cultures developed as a streptococcus analogous to the streptococcus pyogenes.

Canon and Pielicke examined the blood of fourteen rubeolous patients, and in all found the same microörganism—a bacillus. Their preparations were stained in the following solution: Concentrated aqueous solution of methyl-blue, 40 parts; solution of eosine (½ per cent. in 70 per cent. alcohol), 20 parts, and distilled water, 40 parts. The preparation was immersed for five to ten minutes in absolute alcohol, and then in the staining fluid for from six to twenty hours at a temperature of 37° C. Sometimes a mixture of 80 parts of the methyl-blue to 20 parts of the eosine was employed. In these preparations the bacillus in question was colored blue. This coloration was sometimes uniform; but in other cases the sides or the extremities of the

bacillus were alone stained. The dimensions are variable, the length sometimes equalling the radius of a red blood-corpuscle; while in other forms it is shorter, and the body resembles a diplococcus. Between these two types there are numerous intermediate ones. In some instances the length reaches that of the diameter of a red blood-disc, and this form does not stain regularly, but presents alternate clear and colored stripes. This variety is often curved and is observed toward the end of the disease—sixth day.

The number of bacilli in the blood was very variable; sometimes only a few being found on the second or third preparation; while in other cases the whole field of the first slide was occupied by the bacillus in large numbers. They were often isolated, but in the majority of cases (twelve) were grouped in collections of eight to twenty individuals.

This bacillus was found during the progress of the disease; in one case it was observed three days after defervescence. Examination of the blood of seven other children, who had just recovered, gave negative results; and in one uncomplicated case examined ten hours after death, the results were uncertain. By the method of Gram these bacilli refused to take the stain.

Bacilli identical in form with those described as found in the blood were detected also in the expectoration and the nasal and conjunctival secretions.

Attempted cultures in agar-glycerin, blood-serum, or human milk, were without result; while in bouillon, in three cases, cultures were successful in producing similar forms, which also remained sterile in the first three media mentioned.

Having found this bacillus in all of the fourteen cases examined by them, the authors advance the opinion that they have discovered a special microorganism which they regard as the specific agent of the disease.

Secondary Pyrexia in Scarlatina without Local Complications.

It is well known that a recrudescence of fever, after the disappearance of the scarlatinal eruption and the beginning of defervescence, is in the immense majority of cases due to the development of some complication, such as angina, otitis, cervical phlegmon, pleurisy, or nephritis. It is, however, true that in some cases fever may return, may attain a considerable elevation, and be accompanied by grave symptoms, especially of a nervous type, without it being possible to explain the phenomena by the development of any complication. This secondary fever of scarlatina has already been studied by Thomas, who has distinguished several forms, and by Gumprecht, who has collected thirty new observations. This latter observer attributes the symptoms to a secondary infection due to streptococci entering the circulation from the tonsils, which, however, show neither diphtheritic nor marked inflammatory lesions.

In a recent paper on the subject, Bouveret (*Revue de Médecine*, 1892, No. 4, p. 286) reports three cases of this kind observed during a period of twelve years. These three cases, occurring in female adults of seventeen, twenty-two, and thirty-two years, respectively, showed a marked resemblance: normal scarlatina, with a regular defervescence, followed on the eighth to tenth day by a sudden rise of temperature to 104° and to 107⅘° on the succeeding day. No localized cause could be discovered. This violent systemic disturbance

was accompanied by cerebral symptoms of increasing gravity—cephalalgia, agitation, delirium, somnolence, and coma. After systematic use of the cold bath, according to the method of Brand, for two to four or five days, defervescence was reëstablished and progressed regularly to complete recovery.

The author refuses to accept, at least for his own cases, the theory of Gumprecht. He believes the phenomena due most probably to a violent excitation of the thermic centres caused by soluble poisons produced by the microbe of scarlatina and the microbes of secondary infection. He calls attention to what he considers a striking analogy between these phenomena and attacks of cerebral rheumatism, and recommends the persistent and systematic use of the cold bath, to which, he believes, his patients owed their lives.

Tumors of the Bladder in Children.

Phocas (*Congrès Français de Chirurgie*, 1892, Procès-verb.) reports a case of vesical tumor in a boy of six and a half years. He has been able to collect the reports of 25 cases, which, with the five recently contributed by Albarran, give 30 cases, more or less carefully detailed. From a study of these data he draws the following conclusions:

Benign growths are less frequent than malignant. Among functional symptoms, hæmaturia has been noted only very rarely; troubles in micturition, however, are very frequent. From a clinical standpoint these tumors may be classified in two categories—depending upon the sex of the child. In girls the tumor rapidly dilates the urethra and protrudes at the vulva, rendering the diagnosis easy. In boys the bladder itself becomes dilated and appears to contain a large quantity of urine, but catheterization shows the liquid contents to be small. Bimanual examination usually reveals the presence of the neoplastic mass. In 12 cases in little girls operative measures have been resorted to, access to the bladder in the majority of cases being accomplished by way of the urethra. Only two of these cases were reported cured. After 7 operations in boys there were 5 deaths and 2 cures, the latter result being achieved in operations upon non-malignant growths.

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All communications should be addressed to

Dr. EDWARD P. DAVIS,
250 South 21st Street, Philadelphia.